Collateral Effects of a Family-focused Behavioral Intervention on Physical Activity

by

Jenna Rudo-Stern

A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Arts

Approved January 2015 by the
Graduate Supervisory Committee:

Thomas Dishion, Chair
Sharlene Wolchik
Leona Aiken

ARIZONA STATE UNIVERSITY

May 2015

ABSTRACT

There are significant and wide-ranging health benefits of physical activity, yet the majority of adolescents in the United States do not engage in the recommended amount. This poses a significant public health challenge. Parents have a substantial influence on adolescents' levels of activity, indicating that parenting may be an especially salient target of interventions designed to promote physical activity. The current study tested the hypothesis that a family intervention to promote effective parenting would have a positive collateral effect on adolescent physical activity. This study also tested whether the increase in activity was mediated by changes in parental monitoring and family relationship quality. Furthermore, the current study assessed whether adolescent gender moderated the relationship between parental monitoring and physical activity, such that increased parental monitoring predicted increases in physical activity for girls, but not for boys. Participants were 232 adolescents at risk for behavior problems drawn from a larger randomized controlled trial of the Family Check-Up. Adolescents completed questionnaires and participated in a family assessment with their caregivers in the 6th through 9th grades. Youth randomized to the intervention reported significantly more physical activity at follow-up relative to controls. Results failed to confirm the role of family factors as mediators of the effect of the intervention on physical activity. When gender was considered as a moderator, it appeared that parental monitoring was strongly and positively correlated with physical activity for girls, but not for boys. While the mechanism by which the Family Check-Up leads to increased physical activity remains unclear, its robust effects suggest that family intervention can be used to promote physical activity and might therefore have further-reaching health benefits.

ACKNOWLEDGMENTS

I wish to express my sincere appreciation for the way in which my graduate adviser, Dr. Thomas Dishion, has shared with me his vision, enthusiasm, and belief in the importance of the work we do and his commitment to engage in research that benefits society as a whole. I am deeply grateful to Dr. Leona Aiken for her generous and thoughtful guidance through the data analytic process. It is an honor to benefit from her instruction, and I hold enormous respect for her as both a scientist and teacher. I would like also to thank Dr. Sharlene Wolchik for asking important questions, for providing valuable feedback, and for encouraging me along the way. I feel incredibly fortunate to have such a powerful team of thinkers overseeing my academic growth and development. In addition to the guidance and support provided by the members of my thesis committee, I have also had the distinct pleasure of puzzling my way through this project with the help of Hanjoe Kim, Dr. J. D. Smith, Charlotte Winter, Dr. Danielle Shore, and Michaeline Jensen. I appreciate your generosity, patience, knowledge, and insight; thank you. I offer my thanks also to Jake Heckathorn, who gave his unflagging support throughout the research and writing process. I would like also to acknowledge that data used in this study was collected for research supported by National Institute on Drug Abuse grant DA007031, awarded to Dr. Thomas Dishion.

TABLE OF CONTENTS

Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

Introduction

There are significant and wide-ranging health benefits of physical activity, yet the majority of adolescents in the United States do not engage in the recommended amount of activity (Biddle et al., 2004). This poses a significant public health challenge. Parents have a significant influence on adolescents' levels of activity, indicating that parenting may be an especially promising target for interventions to promote physical activity (Sallis et al., 2000). By providing encouragement and instrumental support, parents may increase their adolescent's physical activity (Pugliese and Tinsley, 2007). Such encouragement and support may be more likely to exist in an atmosphere characterized by close family relationships and high levels of monitoring. This study examines whether an intervention that targets parent behaviors and family factors results in a collateral benefit on adolescents' level of physical activity. If this hypothesis is supported, interventions targeting parent behaviors and family factors could be adapted to explicitly promote physical activity.

Physical Health Benefits of Physical Activity

There is substantial evidence to suggest that individuals who are more physically active experience healthier and longer lives than do individuals leading a sedentary lifestyle. In a review of the health benefits of physical activity and fitness, Blair, Cheng, and Holder (2001) found that physical activity reduces the risk for cardiovascular disease, colon cancer, and stroke in adults. Although the literature on the short- and long-term health benefits of youth physical activity is mixed, the literature indicates that physical fitness ought to be encouraged during adolescence (Biddle et al., 2004; Sallis and Patrick,

1994; Strong et al., 2005). Hallal, Victora, Azevedo, and Wells (2006) found that the literature supports a link between physical activity in adolescence and physical activity in adulthood, which contributes to subsequent good health and longevity. The short-term health benefits of adolescent physical activity include higher levels of cardiorespiratory fitness, lower body fat, lower blood pressure, and improved bone density (Biddle et al., 2004; Hallal et al., 2006). Physical activity in adolescence also protects against cardiovascular disease and obesity, which is associated with type II diabetes mellitus and dyslipidemia during adolescence and with increased risk of various health conditions in adulthood (Biddle et al., 2004). Evidence also suggests that physical activity in adolescence has a preventive effect for breast cancer (Hallal et al., 2006). Furthermore, sedentary behaviors (e.g., television-viewing) in adolescence are associated with poor health in adulthood (Hancox et al., 2004; Landhuis et al., 2008; Thorp et al., 2011).

Mental Health Benefits of Physical Activity

In addition to benefiting physical health, evidence suggests that increased levels of physical activity improve psychological well-being, especially increasing self-esteem and reducing depression and anxiety (Biddle et al., 2004; Hallal et al., 2006). Furthermore, engaging in recommended levels of exercise reduces symptoms of depression in adults (Dunn et al., 2005). Meta-analyses find exercise therapy has positive effects on depression and anxiety in youth (Larun et al., 2006). Exercise may benefit mental health through several physiological and psychosocial mechanisms. First, physical activity improves monoamine function and reduces HPA axis sensitivity to stress. Second, it may distract from negative cognitions and emotions, and improve global and

domain-specific self-evaluations due to increased behavioral accomplishment. Finally, because exercise is valued by society, exercise can lead to an increase in self-esteem (Brosse et al., 2002).

Trends in Adolescent Physical Activity

In the 1990s, when data for this study were collected, national physical activity guidelines recommended engaging in moderate physical activity for at least 30 minutes per day on at least five days of each week and engaging in vigorous physical activity for at least 20 continuous minutes on at least three days each week (Sallis and Patrick, 1994). Population studies, such as the Youth Risk Behavior Survey (YRBS), indicate that, over the past two decades, a substantial proportion of youth have not been meeting the national guidelines (Biddle et al., 2004; Brownson and Boehmer, 2005; Eaton et al., 2012; Eaton et al., 2010; Kann et al., 1996; Sallis et al., 2000). The YRBS conducted in 1995 found that over one-third (36.3%) of high school students throughout the United States had not met the guideline regarding vigorous physical activity. Only 21.1% of students nationwide had engaged in moderate activity, defined as walking or bicycling for at least 30 minutes on five or more of the seven days preceding the survey. Because self-report of activity may be less accurate than direct measures, Pate and colleagues (2002) conducted a study using accelerometers to measure students' physical activity and compliance with these guidelines. They found that while over 90% of the students were in compliance with the guideline regarding moderate activity, less than 3% of the students met the recommendations regarding vigorous activity. The results of more recent

studies on youth physical activity confirm that adolescents continue to engage in less than the recommended level of activity (Eaton et al., 2012; Eaton et al., 2010).

Certain socio-demographic factors are related to levels of adolescent physical activity; these include ethnic minority status, socioeconomic status, and child gender. One of the most consistent findings in the literature on adolescent physical activity is that boys are more active than girls during adolescence (Eaton et al., 2012; Eaton et al., 2010; Kann et al., 1996; Sallis et al., 2000; Van der Horst et al., 2007). Socioeconomic status has been found to be positively correlated with physical activity in children, but may exert less influence for adolescents (Gordon-Larsen et al., 2000; Sallis et al., 2000; Taylor et al., 1994; Van der Horst et al., 2007). Socioeconomic status may influence adolescents' activity through exposure to sports and extramural activities, physical education in school, proximity to safe and open spaces for recreation, and transportation to and financial resources for physical activities. Ethnic minority status is consistently associated with physical activity as well; specifically, non-Hispanic Whites have been shown to be more active than other ethnic groups (Gordon-Larsen et al., 1999; Sallis et al., 2000). On the other hand, ethnic minority youth are more likely to report engaging in more moderate activity by walking or cycling, while non-Hispanic Whites report more vigorous activity, in part because they are more likely to play on sports teams (Kann et al., 1996).

Family Factors Related to Physical Activity

Given the numerous positive effects of moderate to high levels of physical activity, the deleterious effects of low levels of physical activity, and the currently sub-

optimal levels of physical activity in the adolescent population, there is a pressing need for interventions that promote physical activity in youth. In order to create an effective intervention, it is important to first consider the determinants of physical activity in this population from an ecological perspective (Dishion and Patterson, 1999).

Parental influence has been included in several models of youth physical activity (Taylor et al., 1994; Trost et al., 2003; Welk, 1999). Social learning theory posits that there is a reciprocal relationship between an individual's behavior and his or her environment and suggests that the family, as the primary unit of socialization, has a foundational influence on children's behaviors in multiple domains, including levels of physical activity. Parents model physical activity, offer reinforcement and encouragement for their child's activity, and provide opportunities for physical activity through transportation and payment of recreational fees. Sallis, Prochaska, and Taylor (2000) found that parental encouragement and instrumental support were consistently and positively related to adolescent physical activity. Similarly, a study of African American girls found a positive relationship between parents' support of their daughters' physical activity, their self-efficacy for engaging in physical activity with their daughter, and the girls' level of physical activity (Adkins et al., 2004). Furthermore, while modeling of physical activity by parents may have an influence, parental support appears to be a more important factor in promoting youth physical activity (Gustafson and Rhodes, 2006; Sallis et al., 2000; Sallis et al., 2002; Trost et al., 2003; Welk et al., 2003).

While parent physical activity level and parental support for physical activity are well studied, the influence of broader family factors – such as family cohesion, parent-

child relationship, and parent-child communication – on adolescent physical activity has received less attention in the empirical literature. In the only study of its kind, Ornelas, Perreira, and Ayala (2007) found that family cohesion, parent-child communication, and parental engagement (not necessarily including shared physical activity) predicted higher levels of youth vigorous physical activity assessed one year later. Another study found that adolescent girls who reported having mothers with a more authoritative parenting style (i.e. mothers who set high expectations and offer support) also reported being more physically active (Schmitz et al., 2002). A different study found that boys with authoritative fathers were more physically active five years following assessment than were those who had reported a neglectful paternal parenting style (Berge et al., 2010). In a study of overweight adolescents, higher levels of family connectedness and parental expectations regarding exercise were associated with higher rates of weekly exercise (Mellin et al., 2002). These findings suggest that an intervention focused on improving family management and parent-child relationship quality might have a positive, collateral effect on physical activity. Indeed, an RCT study of a behavioral family intervention targeting parenting practices had a collateral beneficial effect on physical activity in preschool-age children (Brotman et al., 2012). The mediating effects of changes in parenting practices, however, were not studied.

There is reason to hypothesize that parenting practices targeted in family interventions might be relevant to promoting physical activity. Sandler and colleagues (2011) reviewed 46 experimental trials of parenting interventions, ten of which tested for and showed mediation between randomly assigned interventions and changes in youth

behaviors. In the case of youth physical activity, it may be that closer family relationships lead to increased activity as a family. Additionally, a good parent-child relationship may increase children's self-esteem, thereby encouraging greater activity. Alternatively, increased monitoring may lead parents to involve their children in more organized physical activities.

Research has demonstrated gender differences in parental monitoring. A number of studies indicate that girls experience a higher level of parental monitoring than do boys (Flannery et al., 1994; Li et al., 2000; Pettit et al., 2001). Additionally, boys' and girls' play activities have been shown to differ, with boys engaging in more physical and rough-and-tumble play (DiPietro, 1981; King et al., 2010). Furthermore, boys are more likely to play away from the home (and away from supervising adults) than girls and are more likely to play team sports and other physically active games (Lever, 1976; Martin and Fabes, 2001). It may be the case that boys who receive little parental monitoring are already fairly physically active, such that increased monitoring does not lead to increased physical activity for them. For girls, however, unsupervised social interactions may be relatively sedentary and increased parental monitoring could lead to greater increases in physical activity via engagement in supervised activities such as organized sports.

Interventions for Physical Activity in Adolescence

Family factors are known influences on adolescent physical activity (Biddle et al., 2004), yet the vast majority of interventions designed to promote physical activity are school-based and few include family components. In a systematic review of controlled trials of interventions to promote physical activity in adolescents, Van Sluisj, McMinn,

and Griffin (2007) identified 24 such studies, only six of which included parent participation. Two of these six interventions included a psychoeducational component for parents, involving a single meeting about physical activity and how to support their children (Haerens et al., 2006; Young et al., 2006). They also received supplementary written materials (e.g., newsletters and suggested homework assignments). Only one study (Nader et al., 1992) focused specifically on the family unit: families attended a series of weekly 90-minute sessions on self-monitoring, goal-setting, problem-solving, and supporting family members in making healthier food choices and engaging in physical activity. This study found an effect on physical activity in a subset of the sample. A more recent study employing a similar, family-focused intervention that specifically targeted nutrition and exercise found significant intervention effects on physical activity in the entire sample (Sacher et al., 2010). While few interventions targeting physical activity have focused on the family, evidence for effectiveness is strongest for interventions involving a family component (Kriemler et al., 2011; Van Sluisj et al., 2007).

Despite the fact that family factors such as family cohesion, parent-child communication, and shared activities predict physical activity (Ornelas et al., 2007), none of the current interventions to promote youth physical activity target these psychosocial family factors. Of the interventions described above that incorporate some level of parent participation, most have relegated parent involvement to a peripheral role. Those interventions that do address parent variables focus exclusively on parent support or modeling of physical activity. In the current study, we propose to examine the effects of

the Family Check-Up – an intervention that targets psychosocial family factors – on adolescent physical activity.

The Family Check-Up Intervention

The Family Check-Up (FCU) is an intervention that takes an ecological approach to improving children's behaviors across settings by targeting family management practices and communication (Dishion and Stormshak, 2007). The FCU was originally designed to prevent adolescents on a high-risk trajectory (e.g., school drop-out, substance use, early sexual debut, delinquency) from continuing on that path. The intervention aims to draw parents' attention to their adolescent's antisocial behavior and their own linked family management practices (Dishion and Kavanagh, 2003; Dishion and Stormshak, 2007).

The FCU follows an adaptive framework in which services are tailored to participants' needs. Some families receive more services than others, and some receive more support in certain areas (e.g. monitoring daily activities) while others receive intervention targeting a different component (e.g. positive communication). Such adaptive interventions, responsive to differing needs in terms of content and intensity, are expected to yield more positive outcomes, decrease negative intervention effects, and increase the efficiency of the intervention (Collins et al., 2004).

The FCU is the product of a series of intervention studies. Initially, a component of the intervention had parents of high-risk adolescents meet as a group. A focus on family management in these parent groups reduced observed coercive parent-adolescent interactions, adolescent antisocial behavior at school, and adolescent tobacco use

(Dishion and Andrews, 1995; Dishion et al., 1996). It was revealed that changes in coercive parent-adolescent interactions mediated intervention effects on problem behavior (Dishion et al., 1992). Later interventions honed in on parenting practices such as monitoring, limit-setting, and positive behavior support. Studies showed that changes in parental monitoring mediated reductions in adolescent substance use (Dishion et al., 2003). Family factors such as family conflict and relationship quality were also targeted. While youth in high-risk families who did not engage in the FCU reported a steep increase in family conflict over time, conflict in families who received the intervention remained relatively stable (Van Ryzin et al., 2012). Similarly, an intention-to-treat analysis showed that youth-report of relationship quality in families assigned to the intervention group declined less sharply over time than it did in control families (Van Ryzin and Nowicka, 2013). These demonstrated effects on parenting practice and other family factors by the Family Check-Up, and the relationship between these factors and physical activity, suggest that the Family Check-Up could have an effect on physical activity.

The Current Study

The current study seeks to replicate the findings of Brotman and colleagues (2012) that an intervention targeting family management can have a collateral positive effect on physical activity, extending these findings to adolescents and also exploring the role of parenting factors as mediators of this effect. The current study tests the hypothesis that the Family Check-Up improves parental monitoring and family relationship quality and results in a collateral benefit on adolescents' physical activity (see Figure 1). Data are

drawn from a randomized trial targeting family and individual risk factors for antisocial behavior and substance use. While the FCU does not specifically target physical activity, it does target parenting factors that may contribute to this outcome.

It may also be the case that gender moderates the effect of parental monitoring on physical activity. During leisure time, boys engage in more physical activities than do girls (King et al., 2010; Lever, 1976). Girls are also more likely to experience higher levels of parental monitoring than are boys (Flannery et al., 1994; Li et al., 2000; Pettit et al., 2001). It may be the case that boys, unsupervised and left to their own devices, are already relatively active. In this case, increased parental monitoring is unlikely to lead boys to greater levels of physical activity. On the other hand, girls who are left unsupervised and not actively encouraged to participate in physical activities are more likely to engage in relatively sedentary social activities such as going to a movie or "hanging out" (King et al., 2010). For girls, it may be that an increase in parents' desire to monitor their daughters may lead them to encourage their daughters to participate in structured sports or other supervised physical activities.

This study adds to the literature on family-focused intervention and physical activity in several important ways. First, the collateral benefits of a family-based intervention targeting parenting factors – such as relationship quality and parental monitoring – on adolescents' physical activity levels are tested. Second, family relationship quality and parental monitoring are tested as mediators of the effect of the intervention on physical activity. Third, gender is tested as a moderator of the effect of

parental monitoring on physical activity, such that parental monitoring more strongly predicts physical activity for girls than for boys.

It is notable that this study addresses physical activity in early adolescence, as this is a time when physical activity tends to decline (Eaton et al., 2012; Eaton et al., 2010; Kann et al., 1996; Pate et al., 2002; Sallis, 2000). Furthermore, the sample is predominantly of low socioeconomic status, which has been associated with lower levels of activity compared to adolescents of higher socioeconomic status (Sallis et al., 1996).

Physical activity and parenting factors (parental monitoring and relationship quality) were measured, at staggered time points, at baseline (represented in *Figure 2* as 6th Grade School Assessment and 7th Grade Family Assessment and identified in the study data files as Wave 1) and two years after group assignment to the FCU or to middle school as usual (represented in *Figure 2* as 8th Grade School Assessment and 9th Grade Family Assessment and identified in the study data files as Wave 3). Intervention effects on these variables, controlling for baseline levels of these variables and of covariates, are tested. Additionally, the hypothesized relationship between physical activity and each parenting factor is tested. A mediation analysis to establish the role of parenting factors in the intervention effect on youth physical activity is also proposed.

The specific hypotheses are:

1. The Family Check-Up will result in greater levels of adolescent-reported physical activity assessed two years after study enrollment.
2. Parenting factors (i.e. relationship quality and parental monitoring) will mediate the intervention effect on adolescent physical activity.

3. Gender will moderate the relationship between parental monitoring and youth physical activity.

Methods

Participants

Data for the current study was drawn from a larger, multi-wave, randomized controlled trial of the FCU referred to as Project Alliance 1 (Dishion and Kavanagh, 2003). The study enrolled 6th grade students from three urban and ethnically diverse middle schools in the Pacific Northwest. A first cohort (n = 674) was recruited and then a second cohort (n = 324) was recruited two years later. All participants were assessed for risk of future behavior problems and identified as belonging to a low, moderate, or high risk group based on a teacher-rating measure of child conduct problems in the school arena (Soberman, 1995). Teacher ratings of child conduct problems have been shown to be among the most sensitive instruments for predicting child behavior problems (Loeber and Dishion, 1983).

Only the moderate- or high-risk participants of the first cohort were assessed for physical activity at two-year follow-up.[1] For this reason, only data from the moderate- or high-risk families in the first cohort were considered for inclusion in this analysis. Sixty-two percent of these families eligible for inclusion in the present study agreed to participate in a family assessment at baseline. Only these families, for whom there is baseline data on physical activity, were included in the present analysis (N = 232). Participation rates for these families are presented in Figure 2.

[1] Funding shortfalls led to dropping the family assessments for the second cohort in the 9th grade.

The target middle schools were chosen based on their profile of serving families primarily of low socioeconomic status. Parents of all 6th grade students from these three middle schools were approached for participation and more than 90% consented. The study paid students $20 for completing the initial school assessment and/or returning the consent form whether or not consent was given. Participating families provided information on parent employment status, parent education level, gross annual income, financial aid received, and level of housing. This information was used to assess the socioeconomic status of the sample and confirmed that the majority of participating families were classified as low socioeconomic status. The families included in this analysis reported yearly family income ranging from less than $5,000 to more than $90,000, with median income in the range of $25,000–$29,999. The highest reported education for a caregiver for each family ranged from less than 7th grade to a graduate or professional degree, with 1-3 years of college the median highest reported level of caregiver education. Forty-four families (19%) in the sample reported receiving food stamps.

Participating adolescents and their families were randomized at the individual level to the FCU group or to a middle school as usual control condition. Seventy-eight percent of the families included in this analysis participated in the two-year follow-up family assessment.

Of the at-risk subsample used for this study, 117 students were randomly assigned to the intervention condition and 115 students were assigned to the control group. Families were told of their intervention status following the 7th Grade Family Assessment

and those in the intervention group were invited back to receive feedback on the assessment and could opt for additional services. Of the total subsample, 113 were male and 119 were female; mean age of the adolescent at first assessment was 12.20 years (*SD* = .36) (referred to here as 6th Grade School Assessment), 12.82 years (*SD* = .39) at the 7th Grade Family Assessment, 14.01 years (*SD* = .38) at the 8th Grade School Assessment, and 14.94 years (*SD* = .39) at the 9th Grade Family Assessment. Child reported racial/ethnic background of the subsample was representative of the Portland area at the time the study was conducted: 90 (38.8%) European American, 97 (41.8%) African American, 3 (1.3%) Native American, 10 (4.3%) Hispanic/Latino, 2 (0.9%) Asian American, and 21 (9.1%) other or multiple ethnicities.

Procedure

This Project Alliance intervention trial was designed as a multilevel approach to support middle-school families living in high-risk neighborhoods, with the goal of preventing the onset of adolescent problem behaviors (Dishion and Kavanagh, 2003). At the universal level, families had access to a family resource center that provided parenting resources, referrals, and general information. Staff at the family resource center provided brief consultations and delivered feedback to parents about their student's school performance and classroom behavior.

The select level of intervention used in this study was the Family Check-Up. The Family Check-Up is comprised of three sessions potentially followed with further parent management training. In the first session of the Family Check-Up, the therapist took a motivational interviewing approach to learn more about the challenges the family was

facing and to increase their interest in behavior change and motivation to participate in the family assessment. The second session was used to gather more information about the family via a multi-method, ecological assessment comprised of questionnaires and direct observation tasks (a member of the research team videotaped the family in the home engaging in structured interaction tasks). Finally, parents participated in a feedback session in which they discussed with the therapist the results of the assessment and strategized for positive change, potentially through further involvement in intervention services. For this third session, the therapist employed a motivational interviewing approach (Miller and Rollnick, 2002) with the object of ascertaining whether the family would want to engage in the third level of the intervention (i.e., further intervention services) to receive more support and guidance for changing their family management practices.

Additional intervention typically consisted of parent management training skills consistent with the *Everyday Parenting* curriculum (e.g., monitoring, limit-setting, problem solving, and positive behavior support) (Dishion et al., 2011) and could also have included school or community-based programs. Figure 3 illustrates the progression of the selected and indicated interventions.

Families participating in the study who left the school but who remained in the same county were still offered FCU services. The control group had access to existing school-based services, such as access to a school counselor or psychologist. Of the families assigned to receive the intervention and included in this analysis, 26 (22%) had no contact with an interventionist, 16 (14%) had limited contact with an interventionist

(e.g., by phone or at the family resource center), and 75 (64%) participated in the FCU and received feedback anytime during middle school. The 75 families who received feedback had a minimum of 30 minutes of in-person contact with an interventionist and a maximum of just over 53 hours of contact (3,200 minutes). On average, families who received the Family Check-Up met with an interventionist approximately 9 hours in total (547.87 minutes), over the course of two years, with a standard deviation of 576.45 minutes (or just over 9 hours). Interventionists categorized their contact with families in one or more of the following ways: problem-solving support, behavioral change program, parent group, school meeting, and information. Of the 75 families who received the Family Check-Up, 71 received support, 21 participated in a behavioral change program, 51 participated in a parent group, 13 participated in a school meeting, and all 75 received information.

Questionnaires were given annually in the spring semester from the sixth through eighth grades (ages 12-14) to the target child of the participating families in the schools. Surveys were distributed to students in the schools as part of the School Assessment, with the at-risk and high-risk subsample – evenly divided into the intervention and control groups – receiving an extended assessment at a later time point as part of the Family Assessment.

Measures

Table 1 shows the sample size, minimum, maximum, mean, standard deviation, skewness, and kurtosis for each of the variables included in the model, and for the intervention and control groups separately.

Independent Variable.

Intervention status. For families assigned to the intervention group, intervention status was coded as 1. For families assigned to the control group (i.e., middle school as usual), intervention status was coded as 0.

Dependent Variable.

Physical activity. A single item from the Physical Activity subscale of the Child Health and Illness Profile – Adolescent Edition (Starfield et al., 1994; Starfield et al., 1995) was used to assess physical activity (i.e., "In the past 4 weeks, on how many days did you exercise or play sports hard enough to make you breathe hard, make your heart beat fast, or make you sweat for 20 minutes or more?") The guidelines for physical activity at the time of data collection (in the 1990s) recommended that youth get at least 20 minutes per day of moderate to vigorous physical activity on three or more days each week (Sallis and Patrick, 1994).

Hypothesized Mediating Variables.

Family relationship quality. Adolescents' relationship with their parents was assessed using youth report on a subscale of the Community Action for Successful Youth (Metzler et al., 1998) in the sixth and eighth grades. We created a composite score by averaging across six items that capture the degree to which family members share positive affect, mutual regard, and enjoyable activities (e.g., "My parents and I have gotten along very well with each other," "There was a feeling of togetherness in our family," "The things we did together were fun and interesting"). Responses ranged from 1 (never true) to 5 (always true). Scale reliability (measured by Cohen's alpha) was .89 at

baseline and .90 at two-year follow-up. Metzler and colleagues (1998) demonstrated evidence of test-retest reliability and showed that the scale is predictive of antisocial behavior, association with deviant peers, and substance use. In another study, this measure was shown to predict health-related behaviors, maladaptive eating attitudes, and depression (Van Ryzin and Nowicka, 2013).

Parental monitoring. Youth reports of parental monitoring were measured by averaging across five items drawn from the CASY (Metzler et al., 1998). Items reflected youth perception of how often a parent knows his or her whereabouts, activities, and plans. This scale was part of the adolescent self-report assessments administered in the sixth and eighth grades. Responses ranged from 1 (never true) to 5 (always true). Metzler and colleagues (1998) computed composite reliability – scale reliability across three measurement time points – for the parental monitoring scale and found composite reliability = .90. They also found that the parental monitoring scale showed good convergent validity with other parenting constructs and good discriminant validity with parent-child relationship constructs. Good criterion validity was determined using a model containing the following three criterion variables: associations with deviant peers, antisocial behavior, and substance use. Scale reliability was .85 at baseline and .87 at two-year follow-up.

Hypothesized Moderating Variable.

Gender. Information on gender was collected at baseline and based on youth self-report. (51% of the sample used in this study is female.) Male was coded as 1 and female as 0.

Covariates.

Socioeconomic status. Socioeconomic status (SES) was calculated using parental employment status, parental education, family housing status, family income, and financial aid status, with the highest level between two caretakers chosen when data were available for both. Financial aid status was computed based on whether the family was receiving food stamps, assistance through the Social Security Act and Aid to Dependent Children (ADC), other welfare (not ADC), medical assistance, or Social Security death benefits. Each item was standardized to have a mean of 0 and a standard deviation of 1. The average of these *z*-scores was then computed to create an SES score. Internal consistency of this scale was good (alpha = .73 for baseline SES scores for Cohort 1).

Ethnic minority status. Information on ethnic and racial background was collected at baseline on the youth self-report questionnaires. European American was coded as 1 and any other ethnicity was coded as 0.

Other Baseline Characteristics. The sample used in this study was drawn from a larger study of prevention of problem behavior. To assure that baseline characteristics of the participants did not bias the longitudinal findings, differences between the control and intervention groups on several risk factors for problem behavior were tested. The Teacher Risk Assessment has been shown to have a significant correlation with both parent and student assessment of drug use (Soberman, 1995). Prior research has demonstrated a relationship between the Family Conflict scale and antisocial behavior, deviant peer involvement, and alcohol use (Smith et al., 2014; Van Ryzin and Dishion, 2012). Antisocial behavior has been shown to correlate with juvenile arrest records (Gardner et

al., 2008). Age is related to risky behavior, with adolescents engaging in more risky behavior than those younger or older, and was included in the analysis of baseline characteristics (Steinberg, 2007). Substance use itself is considered a problem behavior and is one of the primary targeted outcomes of the Family Check-Up prevention program. The number of adults and number of children in the home were also included, as these variables have been associated with family stress and compromised parental monitoring (Patterson et al., 1992).

Teacher risk assessment. The Teacher Risk Assessment (TRISK) is a teacher report of youth behavior on 16 items pertaining to classroom behavior, attitude toward school, negative mood, peer relationship problems, and tobacco use. Responses ranged from 1 (never, almost never; equivalent to low risk) to 5 (always, almost always; equivalent to high risk). Reliability for the scale was .95 for the full PAL1 sample.

The TRISK has been shown to have good test-retest reliability (Soberman, 1995). The lowest stability has been found for items regarding family stress and substance use, possibly due to teachers' lack of information regarding these issues relative to things such as academic behavior and internalizing and externalizing behaviors at school (Soberman, 1995). Among high-risk students, the total risk score from the TRISK has been shown to correlate with total scores from teacher and parent reports on Achenbach's Child Behavior Checklist. Similarly, students with no risk factors on the TRISK were shown to have lower overall scores on these other instruments (Soberman, 1995). Moreover, despite relatively low test-retest stability on the Drug Use subscale, teachers' rating on this subscale of the TRISK correlated with parent and student assessment of drug use on

other measures (i.e., teachers could differentiate drug users and nonusers) (Soberman, 1995). This instrument was deemed an appropriate measure for assigning students to risk categories for tiered data collection.

Originally, the plan was to assign students to a risk group according to simple cut-off scores. For the first cohort, the decision rules for assigning a risk category were: if the TRISK score was 3 or higher, then the student was classified as being "high-risk"; if the student's smoking score was 3 or higher, then the student was automatically assigned to the high-risk group; if the TRISK score was 1.5 to 2.99, then the student was classified as "at-risk". In the first year of the study, however, it was discovered that this procedure yielded primarily ethnic minority males in the at-risk groups. The procedure was changed in order to approximate the gender and ethnic distribution in each school. For the second cohort, 15 males and 15 females with the highest TRISK scores from each school and each intervention condition were assigned to the high-risk group; all remaining students with risk scores above 1 were designated "at-risk". All students with a drug risk score of 1 were automatically assigned to the high-risk group. The adjustment to the risk-assignment procedure meant that males and females were deemed to be at moderate- and high-risk relative to the norms of each school and demographic group. The rationale for this change was the desire to give youth of either gender or ethnic minority status equal access to intervention services (Dishion et al., 2003).

Family conflict. Youths' reports of conflicts with parents were measured by averaging across five items drawn from the CASY (Metzler et al., 1998). These items reflected the frequency with which family members engaged in conflict behaviors during

the past month (e.g., “got angry with each other” and “argued at the dinner table”). Responses ranged from 0 (never) to 7 (more than seven times). FCU intervention effects on this measure have been demonstrated to be related to antisocial behavior, deviant peer involvement, and alcohol use (Smith et al., 2014; Van Ryzin et al., 2012). Internal consistency of this scale was good in the full sample (alpha = .81).

Antisocial behavior. A composite score of antisocial behavior was computed across nine items measuring the frequency with which the participant has engaged in behaviors such as lying, stealing, and physical violence in the past month. This measure has been shown to correlate with juvenile arrest records (Gardner et al., 2008). The internal consistency of this scale was good in the full sample (alpha = .83).

Age. Youth reported their date of birth and the date of assessment. From this information, age at each time of assessment was calculated (in months).

Substance use. Youth reported on their substance use in the last month (i.e., number of cigarettes smoked, number of times used chewing tobacco or snuff, number of drinks of alcohol, number of times smoked marijuana or hashish, and number of times used stimulants). These items were drawn from the CASY (Metzler et al., 1998).

Number of adults and children in the home. Parents reported at baseline on a demographics questionnaire the number of adults and the number of children who live in their home.

Data Analysis

Sample statistics, correlations, and hierarchical regressions were computed using SPSS Version 20. The full model was tested using an intention-to-treat analysis in a path

analysis framework with the software program Mplus (Muthén and Muthén, 1998-2012). In order to test the hypotheses, zero-order and partial correlations were computed and hierarchical regressions and path analysis were conducted.

Correlational Analyses

Correlational analyses were performed to assess the strength and direction of the bivariate relationships between the parenting and physical activity outcomes and intervention status. The zero-order correlations among the variables are presented in Table 3. None of the variables were more than moderately correlated when examined for the full sample in the current study.

Correlations involving intervention status were estimated first at an intention-to-treat level, then comparing the control group with families in the intervention group who had any level of contact with an interventionist, and then comparing the control group with families in the intervention group who received the FCU including feedback.

Hierarchical Regressions

The following hypotheses were further tested through hierarchical regression: 1) the intervention will predict physical activity, 2) family relationship quality and parental monitoring will predict physical activity, 3) the intervention will predict family relationship quality and parental monitoring. In order to test the first and third of the above hypotheses, hierarchical regressions were conducted by first including a set of predictors including baseline levels of the criterion and demographic factors (i.e., gender, SES, and ethnic minority status), then adding intervention status to test whether it would account for variation in the criterion over and above the covariates. In order to test the

second hypothesis – that the parenting factors will predict physical activity – physical activity at follow-up was regressed on baseline physical activity, gender, SES, and ethnic minority status. The parenting factor was next added to this model to see whether it accounted for variation in physical activity over and above the covariates. Hierarchical regressions were conducted first at the intention-to-treat level and then for a subsample including only families who received the Family Check-Up and families in the control group.

Path Analysis of the Full Model

Finally, an intention-to-treat analysis of the full model in a path-analysis framework was conducted using Mplus 7.1 (Muthén and Muthén, 1998-2012). For this analysis, maximum likelihood estimation with robust standard errors (MLR) was used. When data are missing completely at random (MCAR), meaning that the reason a piece of data is missing is independent of both the observed variables and unobserved parameters of interest and occurs at random, MLR provides unbiased estimates (MCAR; Little and Rubin, 2002). MLR is also an appropriate approach for treating a data set that contains both non-normally distributed and missing data (Muthén and Asparouhov, 2002). Because MLR works with endogenous variables only, the intercorrelations of all the variables measured at baseline were specified, such that these covariates were considered in the treatment of missing data.

Results

Sample statistics

Table 2 shows the results of independent *t*-tests run on each of the variables in the study, comparing the means of the intervention and control groups. The only variable for which there was a significant difference between the groups was baseline physical activity, $t(230) = 2.54$, $p = .012$, with the control group demonstrating higher physical activity than the intervention group. To control for any baseline differences, baseline variables are included in the model as covariates.

Family Check-Up and Physical Activity

The Family Check-Up was hypothesized to result in greater levels of adolescent physical activity. In order to test for this proposed positive association between the intervention and physical activity, partial correlations were computed, with variance due to baseline physical activity – which was significantly different between the control and intervention groups – partialed out. At the intention-to-treat level, intervention status was reliably correlated with physical activity; intervention status was associated with increased physical activity ($r = .145$, $p = .052$, $n = 182$). When the intervention group included only the families who had some level of contact with an interventionist, intervention status was significantly correlated with family relationship quality ($r = .175$, $p = .025$, $n = 165$). When the intervention group included only the families who participated in the FCU and received feedback, intervention status was significantly correlated with physical activity ($r = .184$, $p = .024$, $n = 152$). These correlations

indicated a small association between participation in the intervention and subsequent physical activity (Cohen, 1988).

Next, hierarchical regressions were conducted to further test whether the Family Check-Up would result in greater levels of adolescent-reported physical activity assessed two years after study enrollment. This analysis was conducted at the intention-to-treat level. First, physical activity at two-year follow-up was regressed on the baseline level of physical activity and the proposed demographic covariates (i.e., gender, SES, and ethnic minority status). This set of predictors accounted for 11.1% of the variation in physical activity in the sample (adjusted R^2 = .111). Baseline physical activity and gender were the significant predictors in this set, with reported *p*-values of .002. Next, intervention status was added to the model. It accounted for a significant proportion of variation in physical activity over and above the covariates, *F change* (1,176) = 3.890, *p* = .050, and adjusted R^2 = .126. As expected, when this same analysis was conducted on a subsample including only families assigned to the intervention group who received the Family Check-Up and all control families, participation in the Family Check-Up contributed to variation in physical activity over and above the covariates, *F change* (1, 146) = 5.994, *p* = .016, and adjusted R^2 = .139. These findings lend support to the hypothesis that the intervention will result in higher levels of physical activity. When path analysis was conducted for the full mediational and moderated mediational models, this finding was repeated in each of the three models tested as well as in a fourth, post-hoc analysis (path coefficients are reported in Tables 4-7). The intervention appears to have a positive collateral effect on youth physical activity.

Family Relationship Quality and Physical Activity

Family relationship quality was hypothesized to predict physical activity. A zero-order correlation was computed to test for a positive relationship between these two variables. Family relationship quality and physical activity were significantly correlated (r = .161, p = .035, n = 172). In order to further test whether family relationship quality might predict adolescent physical activity, hierarchical regression was conducted. To begin, physical activity was regressed on the baseline level of physical activity and the set of demographic covariates, along with intervention status. This set of predictors accounted for 13.2% of the variation in physical activity in the sample (adjusted R^2 = .132). Baseline physical activity, gender, and intervention status were the significant predictors in this set, with reported p-values of < .001, .003, and .031, respectively. Next, family relationship quality was added to the model. It did not account for a significant proportion of variation in physical activity over and above intervention status and other covariates, *F change* (1, 165) = 2.199, p = .140, and adjusted R^2 = .139. When the path from family relationship quality to physical activity was tested in the full mediation model, it was not significant. These paths are reported in Table 4. The results do not support the hypothesis that family relationship quality predicts youth physical activity.

Parental Monitoring and Physical Activity

Parental monitoring was hypothesized to predict physical activity. Parental monitoring and physical activity were not significantly correlated (r = .088, p = .251, n = 172). When hierarchical regressions were conducted, using the full sample, the addition of parental monitoring to a model already including baseline physical activity, gender,

SES, and ethnic minority status as predictors of physical activity did not account for a significant amount of variation in the criterion over and above the contributions of the first set of predictors, *F change* (1, 165) = 2.070, p = .152, and adjusted R^2 = .137. When the path from parental monitoring to physical activity was tested in the full mediational model, it was small and not statistically significant. (Path coefficients for the model are reported in Table 5.) When gender was included as a moderator, the path from parental monitoring to physical activity became substantive and statistically significant. This moderated mediational model is reported in greater detail below and represented in Figure 6, with path coefficients reported in Table 6. The results do not support the hypothesis that parental monitoring predicts all youth physical activity. It appears that parental monitoring predicts physical activity in girls but not in boys.

Family Check-Up and Family Relationship Quality

The Family Check-Up was hypothesized to result in improved youth-reported family relationship quality. A positive relationship between the intervention and family relationship quality was tested first by computing zero-order correlations. At the intention-to-treat level, intervention status was not significantly correlated with family relationship quality (r = .050, p = .475, n = 208). When the intervention group included only the families who had some level of contact with an interventionist, intervention status was not significantly correlated with family relationship quality (r = .068, p = .352, n = 187). When the intervention group included only the families who participated in the Family Check-Up, receiving the intervention was not significantly correlated with family relationship quality (r = .110, p = .150, n = 173). In sum, the intervention did not

correspond to improved youth-reported family relationship in this study according to zero-order correlation analyses.

Next, the relationship between family relationship quality and intervention status was tested by running hierarchical regressions. At the intention-to-treat level, family relationship quality at follow-up was regressed on baseline levels, gender, SES, and ethnic minority status. This set of predictors accounted for 9.3% of the variance in family relationship quality (adjusted R^2 = .093). The addition of intervention status to this model did not contribute prediction over and above the first set of predictors, *F change* (1, 200) = .880, *p* = .349, and adjusted R^2 = .092. At the level of feedback-received, however, intervention status did contribute a significant amount of prediction of family relationship quality over and above the covariates, *F change* (1, 167) = 4.238, *p* = .041, adjusted R^2 = .128.

Again at the more conservative intention-to-treat level of analysis, the relationship between intervention status and youth-reported family relationship quality was examined using path analysis of a full mediational model. The ITT path analysis failed to confirm the hypothesis that the intervention would result in improved relationship quality. Path coefficients are presented in Figure 4 and Table 4.

Family Check-Up and Parental Monitoring

The Family Check-Up was hypothesized to result in increased youth-reported parental monitoring. A positive relationship between the intervention and parental monitoring was first tested by computing zero-order correlations. At the intention-to-treat level, intervention status was not significantly correlated with parental monitoring (*r* =

.067, p = .334, n = 208). When the intervention group included only the families who had some level of contact with an interventionist, intervention status was not significantly correlated with parental monitoring (r = .061, p = .405, n = 187). When the intervention group included only the families who participated in the Family Check-Up, receiving the intervention was not significantly correlated with parental monitoring (r = .093, p = .221, n = 173). At none of the three levels of analysis were intervention status and parental monitoring significantly correlated.

Next, the relationship between parental monitoring and intervention status was tested by running hierarchical regressions. Parental monitoring at follow-up was regressed on baseline levels, gender, SES, and ethnic minority status in an intention-to-treat analysis. This set of predictors accounted for 24.3% of the variance in parental monitoring (adjusted R^2 = .242). The addition of intervention status to this model did not contribute prediction over and above the first set of predictors, *F change* (1, 201) = .110, p = .740, and adjusted R^2 = .238. Including in the sample only those intervention families who received feedback and all control families, intervention status again did not contribute a significant amount of prediction of parental monitoring over and above the covariates, *F change* (1, 167) = .545, p = .461, adjusted R^2 = .277.

Next, path analysis was used to test the relationship between intervention status and parental monitoring. This path was included in the full mediation model and in the model moderated by gender. These ITT path analyses failed to confirm the hypothesis that the intervention would result in increased youth-reported parental monitoring. These path coefficients are presented in Figures 5 and 6 and Tables 5 and 6.

Mediation and Moderated Mediation Analyses

The lack of a positive relationship between intervention status and the parenting factors of interest (i.e. relationship quality and parental monitoring) revealed that these parenting factors might not mediate the intervention effect on adolescent physical activity. While evidence of a significant bivariate correlation between the independent and dependent variables is no longer a requirement to test hypotheses about indirect effects, there must be evidence to suggest a significant path between the independent variable and the mediator and between the mediator and the dependent variable (Hayes, 2009; MacKinnon, 2008). Intervention status did contribute a significant amount of prediction of family relationship quality over and above the covariates in a hierarchical regression conducted on only those in the intervention group who received the Family Check-Up and the controls. There was also a significant zero-order correlation between family relationship quality and physical activity. For this reason, as a post-hoc analysis (beyond the scope of the ITT analysis), bootstrapping was later employed to test for indirect effects in a mediational model.

Family relationship quality. Family relationship quality was hypothesized to mediate the relationship between the intervention and physical activity. This mediational model is shown in Figure 4. The path coefficients of this model are presented in Table 4. Being assigned to the intervention group predicted a 2.7-day increase in physical activity per month (p = .05). Because there was no significant relationship between intervention status and family relationship quality, indirect effects were not tested.

Parental monitoring. Next, the hypothesis that parental monitoring would mediate the intervention effect on physical activity was tested. This model is shown in Figure 5. The path coefficients of this model are presented in Table 5. In this model, being assigned to the intervention group predicted a similar increase (approximately 2.7 days) in physical activity per month (p = .05). Because there was no significant relationship between intervention status and parental monitoring, we did not test for indirect effects.

Gender. The effect of parental monitoring on physical activity was hypothesized to be different for girls than for boys. A moderated mediation model was tested using an interaction term of gender and parental monitoring that was included in the mediation model by regressing physical activity on the interaction term. The path from the interaction term (gender by parental monitoring) to physical activity was significant (β = -.191, p = .024). The path from parental monitoring to physical activity was significant (β = .221, p = .007). The path from intervention status to parental monitoring remained non-significant (β = .021, p = .730). The path from intervention status to physical activity was significant (β = .141, p = .033). The moderated mediation model for gender and parental monitoring is shown in Figure 6. The interaction is displayed in Figure 7. Tests of difference between the levels of physical activity across genders were examined at different levels of parental monitoring. When parental monitoring is one standard deviation above the mean, there are no gender differences in physical activity (b = 1.662, p = .421); whereas when parental monitoring is one standard deviation below the mean, girls are significantly less physically active than boys (b = 7.652, p < .001)(Aiken and

West, 1991). These findings indicate that, for boys, physical activity remains stable across levels of parental monitoring; however, girls' physical activity appears to be higher when parental monitoring is higher.

Family relationship quality for FCU participants. Because family relationship quality and physical activity were significantly correlated and because, at the level of feedback-received vs. controls, intervention status did contribute a significant amount of prediction of family relationship quality over and above the covariates, a post-hoc analysis was conducted to test for indirect effects in the family relationship quality mediation model, including in the analyses only those intervention families who received the Family Check-Up and all families in the control condition. Using the model shown in Figure 8, the analyses were run on this smaller subsample. The path coefficients from this analysis are presented in Table 7. Being assigned to the intervention group predicted an increase (approximately 3.7 days) in physical activity per month (p = .013). Receiving the Family Check-Up feedback predicted an increase in family relationship quality (β = 0.148, p = .025). The indirect effect from receiving the intervention through family relationship quality on physical activity was not significant (the 95% bootstrap confidence interval based on 5000 bootstrap samples was -.250 to .850).

Discussion

The Family Check-Up was designed to promote effective family management practices and has previously been shown to have a range of beneficial effects, such as reductions in substance use, arrests, adolescent and maternal depression, and bullying and improvements in grades and increased school attendance (Connell, 2009; Connell and

Dishion, 2008; Connell et al., 2007; Dishion et al., 2014; Dishion et al., 2003; Shaw et al., 2009; Stormshak et al., 2009). The present study demonstrated that, among youth at risk for behavior problems, this family-focused behavioral intervention had a collateral, positive effect on physical activity in adolescence. Brotman and colleagues (2012) conducted a randomized controlled study of a behavioral family intervention targeting parenting practices and also found an unexpected effect of the family-based intervention on physical activity in preschool-age children. The present study replicated and extended these findings to adolescents. This study also extended the findings of Smith and colleagues (Smith et al., In press) that the Family Check-Up has unintended collateral benefits on physical health behaviors and indicators, specifically nutritional value of meals and BMI, in childhood. These findings are consistent with models that emphasize the role of parenting in the promotion of physical health (Repetti et al., 2002).

This study sought to identify the parenting factors that mediate the relationship between an intervention that targets parenting practice and its effects on physical activity. Family relationship quality and parental monitoring were hypothesized to predict physical activity. While family relationship quality was correlated with physical activity, it did not appear to uniquely predict, when controlling for other covariates, change in physical activity. Parental monitoring was similarly unrelated to physical activity until gender was included as a moderator. Once gender was considered, it appeared that parental monitoring was strongly correlated with physical activity for girls, but not for boys. This finding has implications about gender differences in unsupervised activities

and also suggests that interventions targeting physical activity in girls benefit from addressing parental guidance and monitoring.

While the Family Check-Up has been shown to have positive intervention effects on both parental monitoring and family relationship quality, these effects were not apparent in the current study (Dishion et al., 2003; Van Ryzin and Nowicka, 2013). This discrepancy may be due to the different developmental period, subsample used, and the measure of parental monitoring. When only the intervention families who received the Family Check-Up were compared to families in the control condition, however, receiving the Family Check-Up did contribute to variance in family relationship quality above and beyond baseline levels and covariates. In their analyses of intervention effects on parental monitoring, Dishion and colleagues (2003) used direct observation of the parental monitoring construct, which may be a more sensitive measure than youth report. Van Ryzin and Nowicka (2013) studied the effect of the Family Check-Up on family relationship quality. While they employed the same measure as used in the present study, they looked at a broader developmental time span, focusing on change in family relationship quality over four time points, and used the full Project Alliance sample. These differences in measurement might explain the null findings of the present study regarding intervention effects on family relationship quality and parental monitoring.

While the mechanism by which the Family Check-Up leads to increased adolescent physical activity remains unclear, its robust effects suggest that behavioral family intervention can be used to promote physical activity and might therefore have further-reaching health benefits. It is possible that such an approach could be applied to

broadly defined populations, or its effectiveness may be limited to families of adolescents at risk for behavior problems.

While the physical activity promotion effects of the Family Check-Up are promising, findings should be interpreted in light of limitations. It is important to note that the Family Check-Up was not designed to affect physical activity. Another limitation of this study was that the measures of parenting mediators were not originally intended to capture family factors specifically relevant to physical activity. It may also be the case that the family factors examined here (i.e., parental monitoring and family relationship quality) are not the key factors that influence physical activity. For example, future study might examine the relationship of positive behavior support as a mediator for the effects of parenting interventions on physical activity. It may be the case that an intervention that targets positive behavior support encourages parents to view their child's physical activity as a strength and build on that. Physical activity is widely known to be a positive, healthy behavior and it may evoke relatively little emotional charge as a topic of discussion between parents and youth whose relationship is otherwise strained. For these reasons, it may be a primary topic that parents go to when trying to identify and praise their adolescent's positive behavior.

Further factors that could be considered in future study of family variables and youth physical activity include the type of physical activity youth engage in and with whom they are active, the type of transportation they use to get to and from activities, the financial costs associated with their physical activities, and how much value their parents place on physical activity. It will also be important to investigate whether these findings

that a family intervention can have an effect on physical activity hold when physical activity is measured using accelerometry, which is the current "gold standard" measure of youth physical activity (Wójcicki and McAuley, 2014).

The Family Check-Up was originally designed to prevent risky behaviors such as substance use. Given that the intervention appears to have collateral beneficial effects on healthy behaviors, such as physical activity, it seems reasonable to examine the impact of the Family Check-Up on health practices and health status. Given a more direct focus on these daily practices, larger effects might be observed on these positive outcomes. It is also reasonable to hypothesize that a focus on positive daily behaviors like good sleep hygiene, nutrition, and exercise will continue to have benefits for reducing problem behaviors such as substance use and high risk sexual behavior. The question of whether intervention that encourages healthy behaviors may result in a commensurate decrease in risky behaviors deserves additional investigation.

REFERENCES

Adkins, S., N. E. Sherwood, M. Story, and M. Davis, 2004, Physical Activity among African-American Girls: The Role of Parents and the Home Environment: Obesity research, v. 12, p. 38S-45S.

Aiken, L. S., and S. G. West, 1991, Multiple regression: Testing and interpreting interactions, Sage.

Berge, J. M., M. Wall, K. Loth, and D. Neumark-Sztainer, 2010, Parenting style as a predictor of adolescent weight and weight-related behaviors: Journal of Adolescent Health, v. 46, p. 331-338.

Biddle, S. J., T. Gorely, and D. J. Stensel, 2004, Health-enhancing physical activity and sedentary behaviour in children and adolescents: Journal of sports sciences, v. 22, p. 679-701.

Blair, S. N., Y. Cheng, and J. S. Holder, 2001, Is physical activity or physical fitness more important in defining health benefits?: Medicine and Science in Sports and Exercise, v. 33, p. S379-S399.

Brosse, A. L., E. S. Sheets, H. S. Lett, and J. A. Blumenthal, 2002, Exercise and the treatment of clinical depression in adults: Sports medicine, v. 32, p. 741-760.

Brotman, L. M., S. Dawson-McClure, K.-Y. Huang, R. Theise, D. Kamboukos, J. Wang, E. Petkova, and G. Ogedegbe, 2012, Early childhood family intervention and long-term obesity prevention among high-risk minority youth: Pediatrics, v. 129, p. e621-e628.

Brownson, R. C., and T. K. Boehmer, 2005, Patterns and trends in physical activity, occupation, transportation, land Use, and sedentary behaviors: Transportation Research Board, v. 282.

Cohen, J., 1988, Statistical power analysis for the behavioral sciences: Hillsdale, N.J., L. Erlbaum Associates.

Collins, L. M., S. A. Murphy, and K. L. Bierman, 2004, A conceptual framework for adaptive preventive interventions: Prevention Science, v. 5, p. 185-196.

Connell, A. M., 2009, Employing complier average causal effect analytic methods to examine effects of randomized encouragement trials: The American journal of drug and alcohol abuse, v. 35, p. 253-259.

Connell, A. M., and T. J. Dishion, 2008, Reducing depression among at-risk early adolescents: three-year effects of a family-centered intervention embedded within schools: Journal of Family Psychology, v. 22, p. 574.

Connell, A. M., T. J. Dishion, M. Yasui, and K. Kavanagh, 2007, An adaptive approach to family intervention: linking engagement in family-centered intervention to reductions in adolescent problem behavior: Journal of consulting and clinical psychology, v. 75, p. 568.

DiPietro, J. A., 1981, Rough and tumble play: A function of gender: Developmental Psychology, v. 17, p. 50.

Dishion, T. J., and D. W. Andrews, 1995, Preventing escalation in problem behaviors with high-risk young adolescents: Immediate and 1-year outcomes: Journal of Consulting and Clinical Psychology, v. 63, p. 538.

Dishion, T. J., D. W. Andrews, K. Kavanagh, and L. H. Soberman, 1996, Preventive interventions for high-risk youth: The Adolescent Transitions Program.

Dishion, T. J., L. M. Brennan, D. S. Shaw, A. D. McEachern, M. N. Wilson, and B. Jo, 2014, Prevention of problem behavior through annual family check-ups in early childhood: intervention effects from home to early elementary school: Journal of abnormal child psychology, v. 42, p. 343-354.

Dishion, T. J., and K. Kavanagh, 2003, Intervening in adolescent problem behavior: A family-centered approach, Guilford Press.

Dishion, T. J., S. E. Nelson, and K. Kavanagh, 2003, The family check-up with high-risk young adolescents: Preventing early-onset substance use by parent monitoring: Behavior Therapy, v. 34, p. 553-571.

Dishion, T. J., and G. R. Patterson, 1999, Model building in developmental psychopathology: A pragmatic approach to understanding and intervention: Journal of Clinical Child Psychology, v. 28, p. 502-512.

Dishion, T. J., G. R. Patterson, and K. A. Kavanagh, 1992, An experimental test of the coercion model: Linking theory, measurement, and intervention, *in* J. McCord, and R. E. Tremblay, eds., Preventing antisocial behavior : interventions from birth through adolescence: New York, Guilford Press, p. 253-282.

Dishion, T. J., and E. A. Stormshak, 2007, Intervening in children's lives: An ecological, family-centered approach to mental health care, American Psychological Association.

Dishion, T. J., E. A. Stormshak, and K. A. Kavanagh, 2011, Everyday Parenting: A Professional's Guide to Building Family Management Skills, Research Press.

Dunn, A. L., M. H. Trivedi, J. B. Kampert, C. G. Clark, and H. O. Chambliss, 2005, Exercise treatment for depression: efficacy and dose response: American journal of preventive medicine, v. 28, p. 1-8.

Eaton, D. K., L. Kann, S. Kinchen, S. Shanklin, K. Flint, J. Hawkins, W. Harris, R. Lowry, T. McManus, and D. Chyen, 2012, Youth risk behavior surveillance-United States, 2011: Morbidity and mortality weekly report. Surveillance summaries (Washington, DC: 2002), v. 61, p. 1.

Eaton, D. K., L. Kann, S. Kinchen, S. Shanklin, J. Ross, J. Hawkins, W. A. Harris, R. Lowry, T. McManus, and D. Chyen, 2010, Youth risk behavior surveillance—United States, 2009: MMWR Surveill Summ, v. 59, p. 1-142.

Flannery, D. J., A. T. Vazsonyi, J. Torquati, and A. Fridrich, 1994, Ethnic and gender differences in risk for early adolescent substance use: Journal of Youth and Adolescence, v. 23, p. 195-213.

Gardner, T. W., T. J. Dishion, and A. M. Connell, 2008, Adolescent self-regulation as resilience: Resistance to antisocial behavior within the deviant peer context: Journal of abnormal child psychology, v. 36, p. 273-284.

Gordon-Larsen, P., R. G. McMurray, and B. M. Popkin, 1999, Adolescent physical activity and inactivity vary by ethnicity: The National Longitudinal Study of Adolescent Health: The Journal of pediatrics, v. 135, p. 301-306.

Gordon-Larsen, P., R. G. McMurray, and B. M. Popkin, 2000, Determinants of adolescent physical activity and inactivity patterns: Pediatrics, v. 105, p. e83-e83.

Gustafson, S. L., and R. E. Rhodes, 2006, Parental correlates of physical activity in children and early adolescents: Sports Medicine, v. 36, p. 79-97.

Haerens, L., B. Deforche, L. Maes, V. Stevens, G. Cardon, and I. Bourdeaudhuij, 2006, Body mass effects of a physical activity and healthy food intervention in middle schools: Obesity, v. 14, p. 847-854.

Hallal, P. C., C. G. Victora, M. R. Azevedo, and J. C. Wells, 2006, Adolescent physical activity and health: Sports Medicine, v. 36, p. 1019-1030.

Hancox, R. J., B. J. Milne, and R. Poulton, 2004, Association between child and adolescent television viewing and adult health: a longitudinal birth cohort study: The Lancet, v. 364, p. 257-262.

Kann, L., C. W. Warren, W. A. Harris, J. L. Collins, B. I. Williams, J. G. Ross, and L. J. Kolbe, 1996, Youth risk behavior surveillance—United States, 1995: Journal of school health, v. 66, p. 365-377.

King, G., M. Law, P. Hurley, T. Petrenchik, and H. Schwellnus, 2010, A Developmental Comparison of the Out-of-school Recreation and Leisure Activity Participation of Boys and Girls With and Without Physical Disabilities: International Journal of Disability, Development and Education, v. 57, p. 77-107.

Kriemler, S., U. Meyer, E. Martin, E. Van Sluijs, L. Andersen, and B. Martin, 2011, Effect of school-based interventions on physical activity and fitness in children and adolescents: a review of reviews and systematic update: British Journal of Sports Medicine, v. 45, p. 923-930.

Landhuis, C. E., R. Poulton, D. Welch, and R. J. Hancox, 2008, Programming obesity and poor fitness: the long-term impact of childhood television: Obesity, v. 16, p. 1457-1459.

Larun, L., L. Nordheim, E. Ekeland, K. Hagen, and F. Heian, 2006, Exercise in prevention and treatment of anxiety and de-pression among children and young people: Cochrane Database of Systematic Reviews, v. 4.

Lever, J., 1976, Sex differences in the games children play: Social problems, p. 478-487.

Li, X., S. Feigelman, and B. Stanton, 2000, Perceived parental monitoring and health risk behaviors among urban low-income African-American children and adolescents: Journal of Adolescent Health, v. 27, p. 43-48.

Little, R. J. A., and D. B. Rubin, 2002, Statistical analysis with missing data: Wiley Series in Probability and Statistics: New York, NY, Wiley.

Loeber, R., and T. Dishion, 1983, Early predictors of male delinquency: a review: Psychological bulletin, v. 94, p. 68.

Martin, C. L., and R. A. Fabes, 2001, The stability and consequences of young children's same-sex peer interactions: Developmental psychology, v. 37, p. 431.

Mellin, A. E., D. Neumark-Sztainer, M. Story, M. Ireland, and M. D. Resnick, 2002, Unhealthy behaviors and psychosocial difficulties among overweight adolescents: the potential impact of familial factors: Journal of adolescent health, v. 31, p. 145-153.

Metzler, C. W., A. Biglan, D. V. Ary, and F. Li, 1998, The stability and validity of early adolescents' reports of parenting constructs: Journal of Family Psychology, v. 12, p. 600.

Miller, W. R., and S. Rollnick, 2002, Motivational interviewing: Preparing people for change, Guilford press.

Muthén, B., and T. Asparouhov, 2002, Using Mplus Monte Carlo simulations in practice: A note on non-normal missing data in latent variable models: Mplus webnotes.

Muthén, L. K., and B. O. Muthén, 1998-2012, Mplus user's guide, Los Angeles, CA, Muthén & Muthén.

Nader, P. R., J. F. Sallis, I. S. Abramson, and S. L. Broyles, 1992, Family-based cardiovascular risk reduction education among Mexican-and Anglo-Americans: Family & Community Health: The Journal of Health Promotion & Maintenance.

Ornelas, I. J., K. M. Perreira, and G. X. Ayala, 2007, Parental influences on adolescent physical activity: a longitudinal study: International Journal of Behavioral Nutrition and Physical Activity, v. 4, p. 3.

Pate, R. R., P. S. Freedson, J. F. Sallis, W. C. Taylor, J. Sirard, S. G. Trost, and M. Dowda, 2002, Compliance with physical activity guidelines: prevalence in a population of children and youth: Annals of epidemiology, v. 12, p. 303-308.

Patterson, G. R., J. B. Reid, and T. J. Dishion, 1992, Antisocial boys: A social interactional approach: Eugene, OR: Castalia.

Pettit, G. S., R. D. Laird, K. A. Dodge, J. E. Bates, and M. M. Criss, 2001, Antecedents and behavior-problem outcomes of parental monitoring and psychological control in early adolescence: Child development, v. 72, p. 583-598.

Pugliese, J., and B. Tinsley, 2007, Parental socialization of child and adolescent physical activity: a meta-analysis: Journal of Family Psychology, v. 21, p. 331.

Repetti, R. L., S. E. Taylor, and T. E. Seeman, 2002, Risky families: family social environments and the mental and physical health of offspring: Psychological bulletin, v. 128, p. 330.

Sacher, P. M., M. Kolotourou, P. M. Chadwick, T. J. Cole, M. S. Lawson, A. Lucas, and A. Singhal, 2010, Randomized Controlled Trial of the MEND Program: A Family-based Community Intervention for Childhood Obesity: Obesity, v. 18, p. S62-S68.

Sallis, J. F., 2000, Age-related decline in physical activity: a synthesis of human and animal studies: Medicine and science in sports and exercise, v. 32, p. 1598-1600.

Sallis, J. F., and K. Patrick, 1994, Physical activity guidelines for adolescents: consensus statement: Pediatric exercise science, v. 6, p. 302-302.

Sallis, J. F., J. J. Prochaska, and W. C. Taylor, 2000, A review of correlates of physical activity of children and adolescents: Medicine and science in sports and exercise, v. 32, p. 963-975.

Sallis, J. F., W. C. Taylor, M. Dowda, P. S. Freedson, and R. R. Pate, 2002, Correlates of vigorous physical activity for children in grades 1 through 12: Comparing parent-reported and objectively measured physical activity: Pediatric Exercise Science, v. 14, p. 30.

Sallis, J. F., J. M. Zakarian, M. F. Hovell, and C. R. Hofstetter, 1996, Ethnic, socioeconomic, and sex differences in physical activity among adolescents: Journal of clinical epidemiology, v. 49, p. 125-134.

Sandler, I., E. Schoenfelder, S. Wolchik, and D. MacKinnon, 2011, Long-term impact of prevention programs to promote effective parenting: Lasting effects but uncertain processes: Annual review of psychology, v. 62, p. 299.

Schmitz, K. H., L. A. Lytle, G. A. Phillips, D. M. Murray, A. S. Birnbaum, and M. Y. Kubik, 2002, Psychosocial correlates of physical activity and sedentary leisure habits in young adolescents: the Teens Eating for Energy and Nutrition at School study: Preventive Medicine, v. 34, p. 266-278.

Shaw, D. S., A. Connell, T. J. Dishion, M. N. Wilson, and F. Gardner, 2009, Improvements in maternal depression as a mediator of intervention effects on early childhood problem behavior: Development and psychopathology, v. 21, p. 417-439.

Smith, J. D., N. B. Knoble, A. A. Zerr, T. J. Dishion, and E. A. Stormshak, 2014, Family check-up effects across diverse ethnic groups: Reducing early-adolescence antisocial behavior by reducing family conflict: Journal of Clinical Child & Adolescent Psychology, p. 1-15.

Smith, J. D., Z. Montaño, T. J. Dishion, D. S. Shaw, and M. N. Wilson, In press, Preventing Weight Gain and Obesity: Indirect Effects of the Family Check-Up in Early Childhood: Prevention Science.

Soberman, L. H., 1995, Psychometric validation of a teacher screening instrument.

Starfield, B., M. Bergner, M. Ensminger, A. W. Riley, B. F. Green, and S. Ryan, 1994, Child Health and Illness Profile-Adolescent Edition (CHIP-AE), Baltimore, MD, The Johns Hopkins University.

Starfield, B., A. W. Riley, B. F. Green, M. E. Ensminger, S. A. Ryan, K. Kelleher, S. Kim-Harris, D. Johnston, and K. Vogel, 1995, The adolescent child health and illness profile: a population-based measure of health: Medical care, v. 33, p. 553.

Steinberg, L., 2007, Risk taking in adolescence new perspectives from brain and behavioral science: Current Directions in Psychological Science, v. 16, p. 55-59.

Stormshak, E. A., A. Connell, and T. J. Dishion, 2009, An adaptive approach to family-centered intervention in schools: Linking intervention engagement to academic outcomes in middle and high school: Prevention Science, v. 10, p. 221-235.

Strong, W. B., R. M. Malina, C. J. Blimkie, S. R. Daniels, R. K. Dishman, B. Gutin, A. C. Hergenroeder, A. Must, P. A. Nixon, and J. M. Pivarnik, 2005, Evidence based physical activity for school-age youth: The Journal of pediatrics, v. 146, p. 732-737.

Taylor, W. C., T. Baranowski, and J. F. Sallis, 1994, Family determinants of childhood physical activity: A social-cognitive model, *in* R. K. Dishman, ed., Advances in exercise adherence: Champaign, IL, England, Human Kinetics Publishers, p. 319-342.

Thorp, A. A., N. Owen, M. Neuhaus, and D. W. Dunstan, 2011, Sedentary behaviors and subsequent health outcomes in adults: a systematic review of longitudinal studies, 1996–2011: American journal of preventive medicine, v. 41, p. 207-215.

Trost, S. G., J. F. Sallis, R. R. Pate, P. S. Freedson, W. C. Taylor, and M. Dowda, 2003, Evaluating a model of parental influence on youth physical activity: American journal of preventive medicine, v. 25, p. 277-282.

Van der Horst, K., M. Paw, J. W. Twisk, and W. Van Mechelen, 2007, A brief review on correlates of physical activity and sedentariness in youth: Medicine and science in sports and exercise, v. 39, p. 1241.

Van Ryzin, M. J., and T. J. Dishion, 2012, The impact of a family-centered intervention on the ecology of adolescent antisocial behavior: Modeling developmental sequelae and trajectories during adolescence: Development and psychopathology, v. 24, p. 1139-1155.

Van Ryzin, M. J., and P. Nowicka, 2013, Direct and indirect effects of a family-based intervention in early adolescence on parent− youth relationship quality, late

adolescent health, and early adult obesity: Journal of Family Psychology, v. 27, p. 106.

Van Ryzin, M. J., E. A. Stormshak, and T. J. Dishion, 2012, Engaging parents in the Family Check-Up in middle school: Longitudinal effects on family conflict and problem behavior through the high school transition: Journal of Adolescent Health, v. 50, p. 627-633.

Van Sluisj, E., A. McMinn, and S. Griffin, 2007, Effectiveness of interventions to promote physical activity in children and adolescents: systematic review of controlled trials: BMJ, v. 335, p. 677-8.

Welk, G. J., 1999, The youth physical activity promotion model: a conceptual bridge between theory and practice: Quest, v. 51, p. 5-23.

Welk, G. J., K. Wood, and G. Morss, 2003, Parental Influences on Physical Activity in Children: an Exploration of Potential Mechanisms: Pediatric Exercise Science, v. 15, p. 19-33.

Wójcicki, T. R., and E. McAuley, 2014, II. Physical Activity: Measurement and Behavioral Patterns in Children and Youth: Monographs of the Society for Research in Child Development, v. 79, p. 7-24.

Young, D. R., J. A. Phillips, T. Yu, and J. A. Haythornthwaite, 2006, Effects of a life skills intervention for increasing physical activity in adolescent girls: Archives of pediatrics & adolescent medicine, v. 160, p. 1255.

Table 1

Sample characteristics

		Intervention Group							Control Group						
	Variable	n	Min.	Max.	Mean	Std. Dev.	Skewness	Kurtosis	n	Min.	Max.	Mean	Std. Dev.	Skewness	Kurtosis
6th Grade School Assessment	Teacher Risk Assessment	117	2.00	3.00	2.34	0.48	0.68	-1.57	115	2.00	3.00	2.36	0.48	0.61	-1.66
	Gender (1 = male)	117	0.00	1.00	0.44	0.50	0.23	-1.98	115	0.00	1.00	0.53	0.50	-0.12	-2.02
	SES	117	-1.61	0.99	0.02	0.62	-0.52	-0.20	115	-2.39	0.99	-0.10	0.79	-0.88	0.22
	Ethnic minority status	117	0.00	1.00	0.38	0.49	0.48	-1.80	115	0.00	1.00	0.39	0.49	0.45	-1.83
	Family Relationship Quality	115	1.00	5.00	3.47	1.10	-0.26	-1.13	115	1.67	5.00	3.48	0.89	0.02	-0.89
	Parental Monitoring	116	1.00	5.00	3.94	1.13	-1.12	0.28	115	1.00	5.00	3.90	0.88	-0.75	0.18
7th Grade Family Assessment	Physical Activity	117	0.00	28.00	10.6	8.96	0.45	-0.96	115	0.00	28.00	13.76	9.99	0.09	-1.41
8th Grade School Assessment	Family Relationship Quality	105	1.00	5.00	3.23	0.99	0.02	-0.68	103	1.00	5.00	3.13	1.09	-0.13	-1.02
	Parental Monitoring	105	1.40	5.00	4.01	0.84	-1.12	1.20	103	1.00	5.00	3.90	0.98	-0.99	0.43
9th Grade Family Assessment	Physical Activity	91	0.00	28.00	15.10	9.69	-0.11	-1.29	91	0.00	28.00	13.40	10.30	0.09	-1.49

Table 2

Independent t-test results comparing intervention and control groups

		Intervention		Control		Differences	
	Variable	n	Mean	n	Mean	*t or* χ^2	*p*
6th Grade School Assessment	Teacher Risk Assessment	117	2.34	115	2.36	*t* = 0.23	0.82
	Age (in months)	117	146.12	115	146.57	*t* = 0.80	0.42
	Gender	117	52m/65f	115	61m/54f	$\chi^2 = 1.72$	0.24
	SES	117	0.02	115	-0.10	*t* = -1.36	0.18
	Ethnic minority status	117	45 EA/72 Other	115	45 EA/70 Other	$\chi^2 = .01$	0.92
	Number of Cigarettes Smoked Past Month	116	.77	115	.52	*t* = -0.85	0.40
	Number of Times Chewed Tobacco Past Month	116	.03	115	.02	*t* = -0.33	0.74
	Number of Alcoholic Drinks Past Month	116	.89	115	.71	*t* = -0.62	0.54
	Number of Times Smoked Marijuana Past Month	116	.38	115	.27	*t* = -0.60	0.55
	Number of Times Used Stimulants Past Month	116	.09	115	.00	*t* = -1.32	0.19
	Antisocial Behavior	116	1.49	115	1.50	*t* = 0.11	0.91
	Family Conflict	116	2.23	115	2.03	*t* = -1.29	0.20
	Family Relationship Quality	115	3.47	115	3.48	*t* = 0.06	0.96
	Parental Monitoring	116	3.94	115	3.85	*t* = -0.68	0.50
7th Grade Family Assessment	Age (in months)	117	153.50	114	154.08	*t* = 0.96	0.34
	Number of Children at Home	112	2.75	100	2.55	*t* = -1.30	0.19
	Number of Adults at Home	112	2.08	100	2.12	*t* = 0.23	0.82
	Physical Activity	117	10.60	115	13.76	*t* = 2.54	0.01*
8th Grade School Assessment	Age (in months)	105	167.83	103	168.50	*t* = 1.07	0.29
	Family Relationship Quality	105	3.23	103	3.13	*t* = -0.72	0.48
	Parental Monitoring	105	4.01	103	3.89	*t* = -0.97	0.33
9th Grade Family Assessment	Age (in months)	91	179.43	90	179.20	*t* = -0.33	0.74
	Physical Activity	91	15.10	91	13.40	*t* = -1.15	0.25

Note. The frequencies are given for Gender and Ethnic minority status. "m" = Male. "f" = Female. "EA" = European American. "Other" = not European American.

Table 3

Zero-order correlations

		1	2	3	4	5	6	7	8	9	10	11
1	Treatment	-										
2	Teacher Risk Assessment	**-.02**	-									
		232										
3	Gender	**-.09**	**-.14***	-								
		232	232									
4	SES T1	**.09**	**-.22****	**.02**	-							
		232	232	232								
5	Ethnic minority status	**-.01**	**-.08**	**.14***	**.40****	-						
		232	232	232	232							
6	Family Relationship Quality T1	**.00**	**-.16***	**.00**	**.04**	**-.14***	-					
		230	230	232	230	230						
7	Parental Monitoring T1	**.05**	**-.21****	**-.06**	**.05**	**.02**	**.41****	-				
		231	231	231	231	231	230					
8	Physical Activity T1	**-.17***	**-.09**	**.21****	**-.02**	**.04**	**.00**	**-.01**	-			
		232	232	232	232	232	230	231				
9	Family Relationship Quality T2	**.05**	**-.10**	**.17***	**-.07**	**-.06**	**.27****	**.14**	**.10**	-		
		208	208	208	208	208	206	207	208			
10	Parental Monitoring T2	**.07**	**-.17***	**-.07**	**.09**	**.00**	**.11**	**.50****	**-.04**	**.38****	-	
		208	208	208	208	208	206	207	208	208		
11	Physical Activity T2	**.09**	**-.12**	**.27****	**.09**	**.06**	**.01**	**.06**	**.28****	**.16***	**.09**	-
		182	182	182	182	182	180	181	182	172	172	

Note. The numbers in bold represent the *r*-values and the numbers below represent the cell size. “T1” refers to baseline and “T2” refers to two-year follow-up.

Table 4

Path coefficients of the full model, family relationship quality

	Estimate (unstandardized)	Estimate (standardized)	S.E.	Est./S.E.	P-Value
Physical Activity T2 ON					
Treatment	2.664	0.134	1.363	1.955	0.051
Phys. Act. T1	0.259	0.248	0.075	3.426	0.001
SES	1.118	0.080	1.186	0.942	0.346
Minority	-0.154	-0.008	1.697	-0.090	0.928
Gender	4.203	0.211	1.517	2.770	0.006
Fam. Relationship T2	1.014	0.105	0.688	1.474	0.140
Fam. Relationship T2 ON					
Treatment	0.145	0.070	0.135	1.072	0.284
Fam. R. T1	0.292	0.28	0.073	3.991	0.000
SES	-0.111	-0.076	0.102	-1.087	0.277
Minority	-0.027	-0.0120	0.158	-0.168	0.866
Gender	0.393	0.189	0.141	2.787	0.005

Note. "T1" refers to baseline and "T2" refers to two-year follow-up.

Table 5

Path coefficients of the full model, parental monitoring

	Estimate (unstandardized)	Estimate (standardized)	S.E.	Est./S.E.	P-Value
Physical Activity T2 ON					
Treatment	2.653	0.133	1.353	1.962	0.050
Phys. Act. T1	0.263	0.252	0.076	3.477	0.001
SES	0.961	0.068	1.218	0.789	0.430
Minority	-0.376	-0.018	1.699	-0.221	0.825
Gender	4.827	0.242	1.491	3.237	0.001
Parental Monitoring T2	1.119	0.102	0.737	1.519	0.129
Parental Monitoring T2 ON					
Treatment	0.042	0.023	0.112	0.379	0.704
Parental Monitoring T1	0.451	0.498	0.066	6.799	0.000
SES	0.103	0.080	0.080	1.278	0.201
Minority	-0.024	-0.013	0.126	-0.194	0.846
Gender	-0.091	-0.050	0.114	-0.800	0.424

Note. "T1" refers to baseline and "T2" refers to two-year follow-up.

Table 6

Path coefficients of the moderated mediation model, parental monitoring and gender

	Estimate (unstandardized)	Estimate (standardized)	S.E.	Est./S.E.	P-Value
Physical Activity T2 ON					
Treatment	2.855	0.141	1.353	2.11	0.035
Phys. Act. T1	0.272	0.256	0.074	3.673	0.000
SES T1	1.371	0.096	1.161	1.181	0.238
Minority	-0.687	-0.033	1.664	-0.413	0.68
Gender	4.657	0.229	1.477	3.153	0.002
Parental Monitoring T2	2.452	0.221	0.934	2.626	0.009
Parental Monitoring x Gender	-3.290	-0.234	1.461	-2.251	0.024
Parental Monitoring T2 ON					
Treatment	0.039	0.021	0.112	0.345	0.730
Parental Monitoring T1	0.452	0.499	0.066	6.821	0.000
SES T1	0.108	0.084	0.081	1.328	0.184
Minority	-0.024	-0.013	0.126	-0.190	0.849
Gender	-0.092	-0.051	0.114	-0.814	0.416

Note. "T1" refers to baseline and "T2" refers to two-year follow-up.

Table 7

Path coefficients, family relationship quality, received the FCU vs. controls

	Estimate (unstandardized)	Estimate (standardized)	S.E.	Est./S.E.	P-Value
Physical Activity T2 ON					
Treatment	3.726	0.183	1.506	2.475	0.013
Phys. Act. T1	0.277	0.266	0.081	3.433	0.001
SES	0.345	0.025	1.211	0.285	0.775
Minority	0.658	0.032	1.826	0.360	0.719
Gender	4.689	0.235	1.609	2.914	0.004
Fam. Relationship T2	0.681	0.070	0.731	0.932	0.352
Fam. Relationship T2 ON					
Treatment	0.312	0.148	0.142	2.196	0.028
Fam. R. T1	0.349	0.340	0.079	4.405	0.000
SES	-0.089	-0.063	0.105	-0.846	0.398
Minority	-0.056	-0.027	0.170	-0.330	0.741
Gender	0.341	0.165	0.152	2.245	0.025

Note. "T1" refers to baseline and "T2" refers to two-year follow-up.

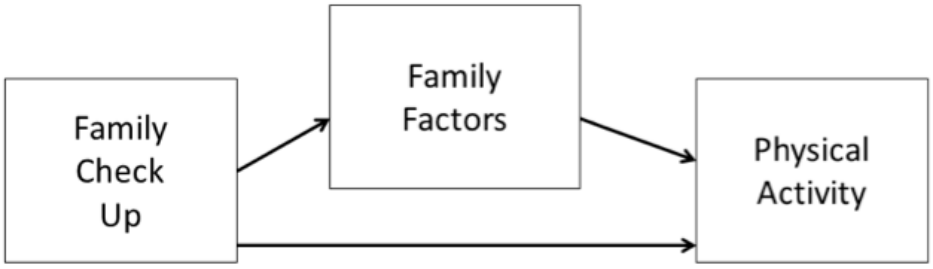


Figure 1. Conceptual model.

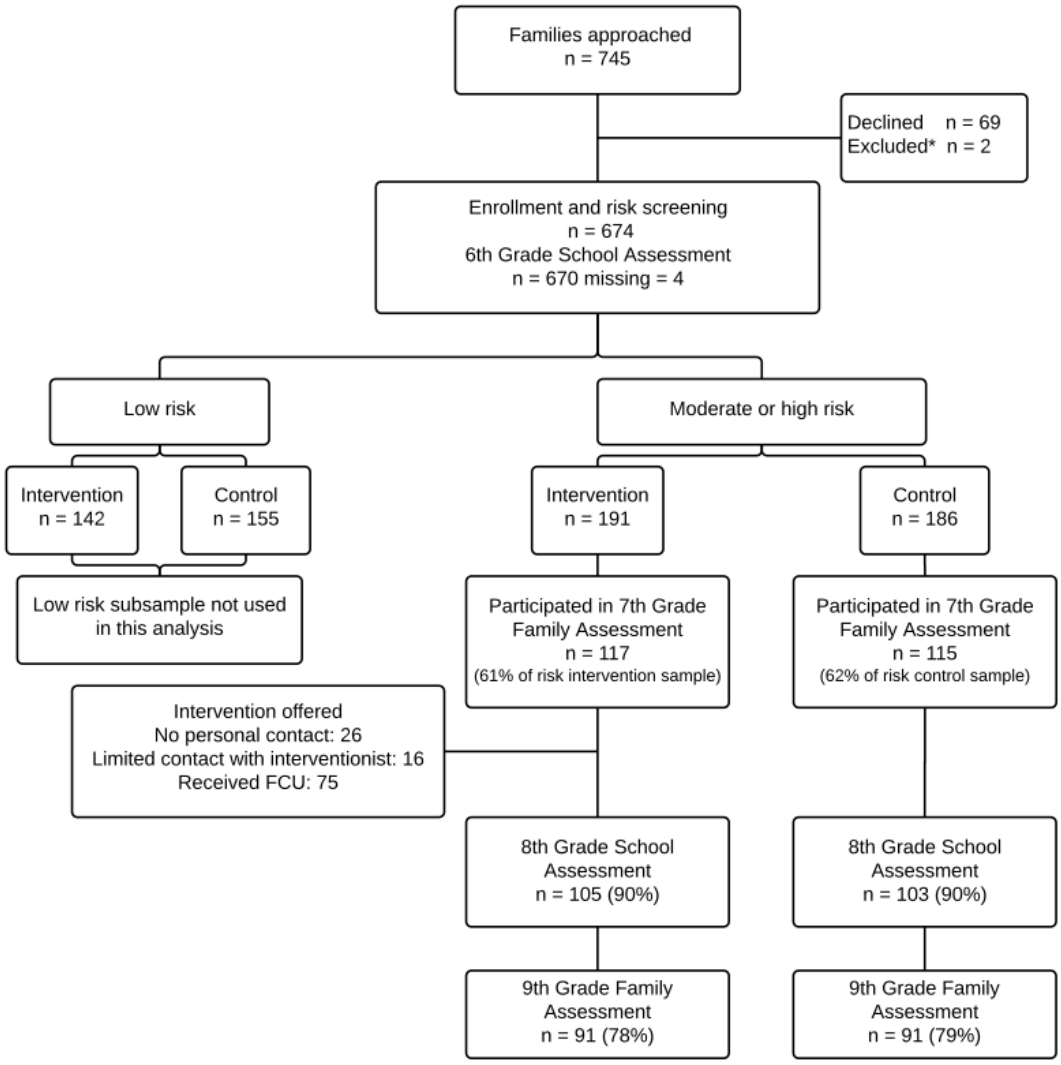


Figure 2. Consort table.

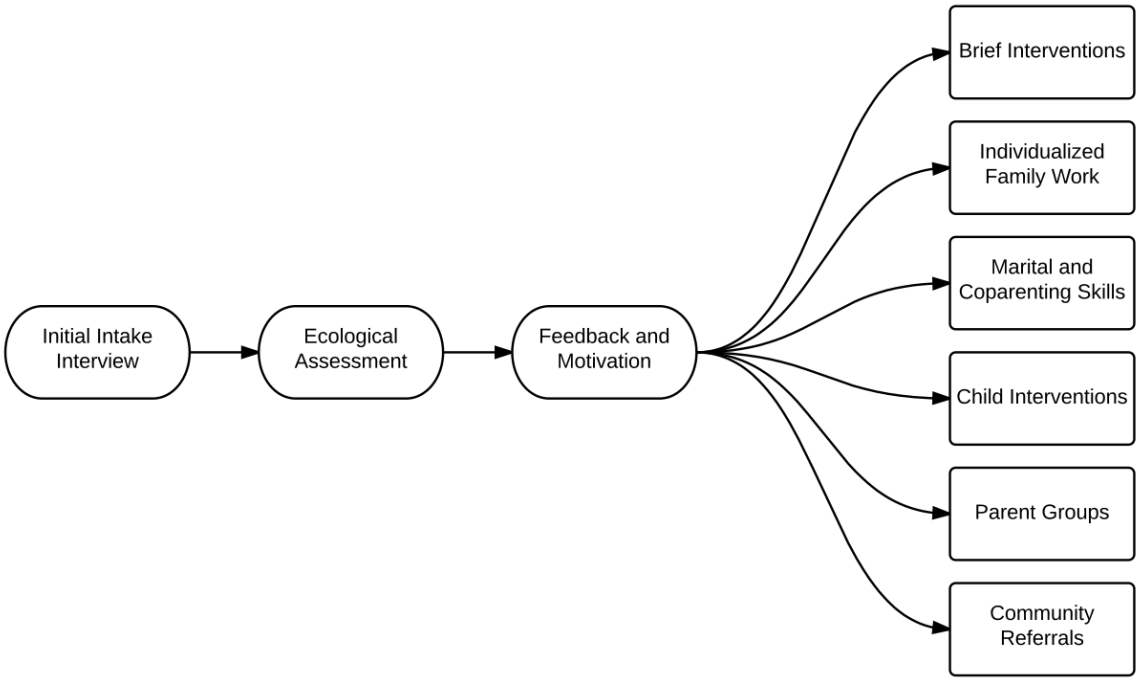


Figure 3. Intervention model.

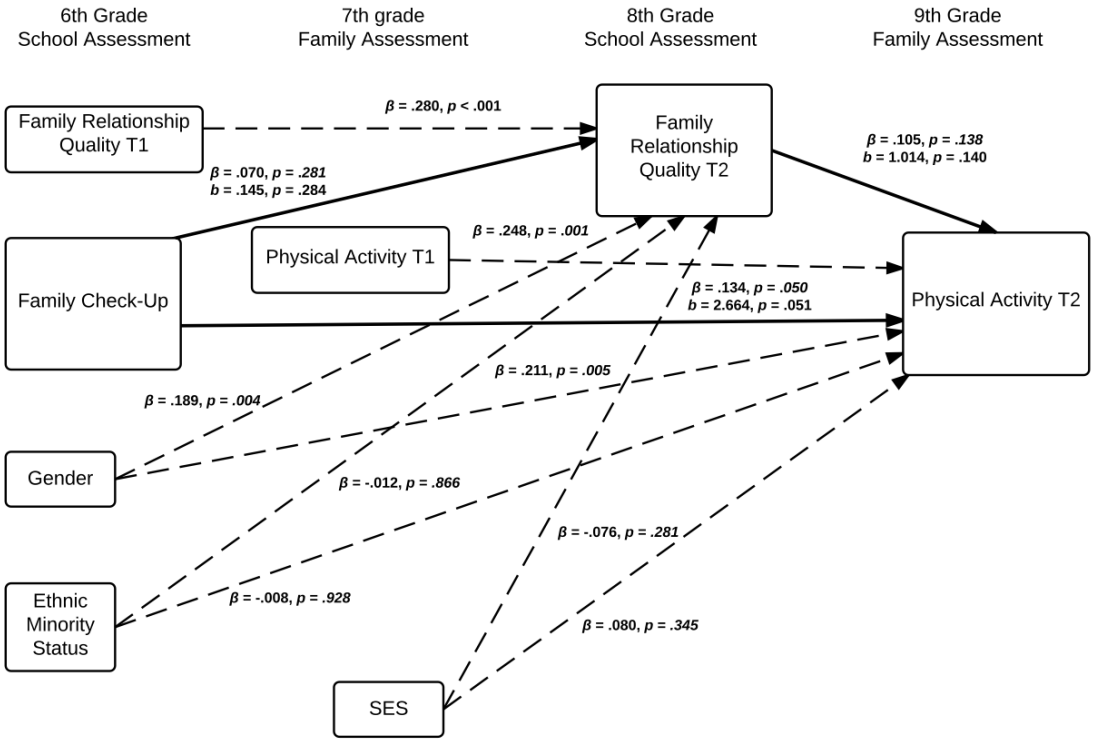


Figure 4. Mediation model, family relationship quality. Shows the path coefficients for the paths of interest.

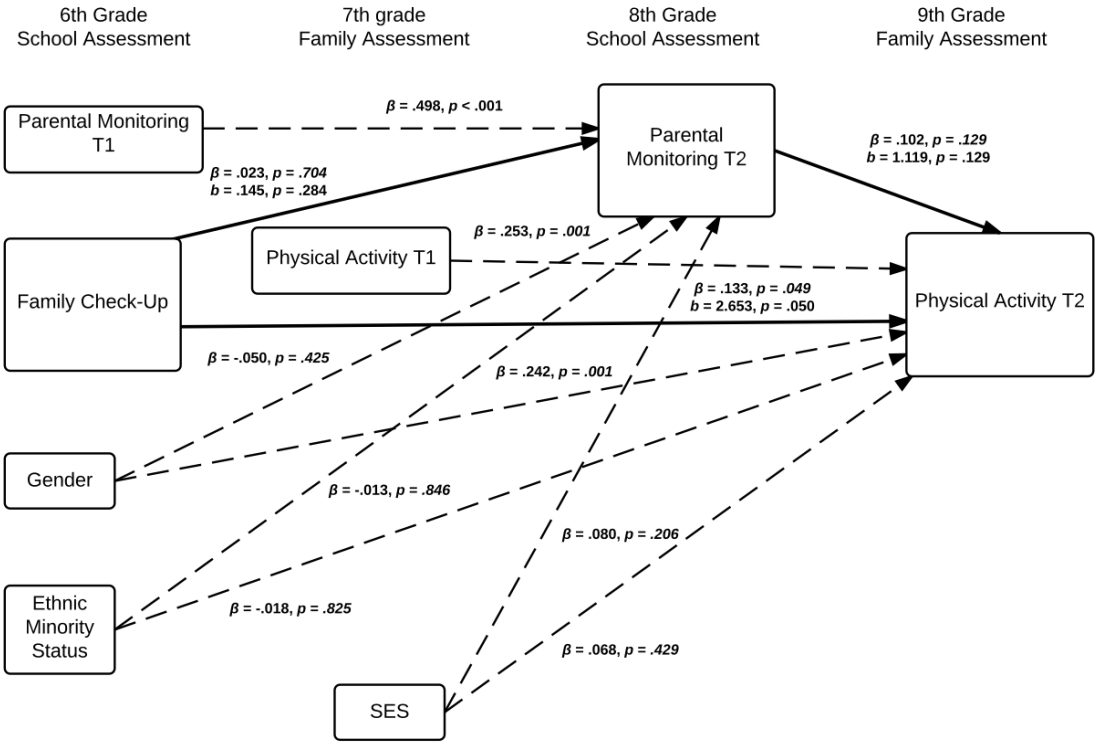


Figure 5. Mediation model, parental monitoring. Shows the path coefficients for the paths of interest.

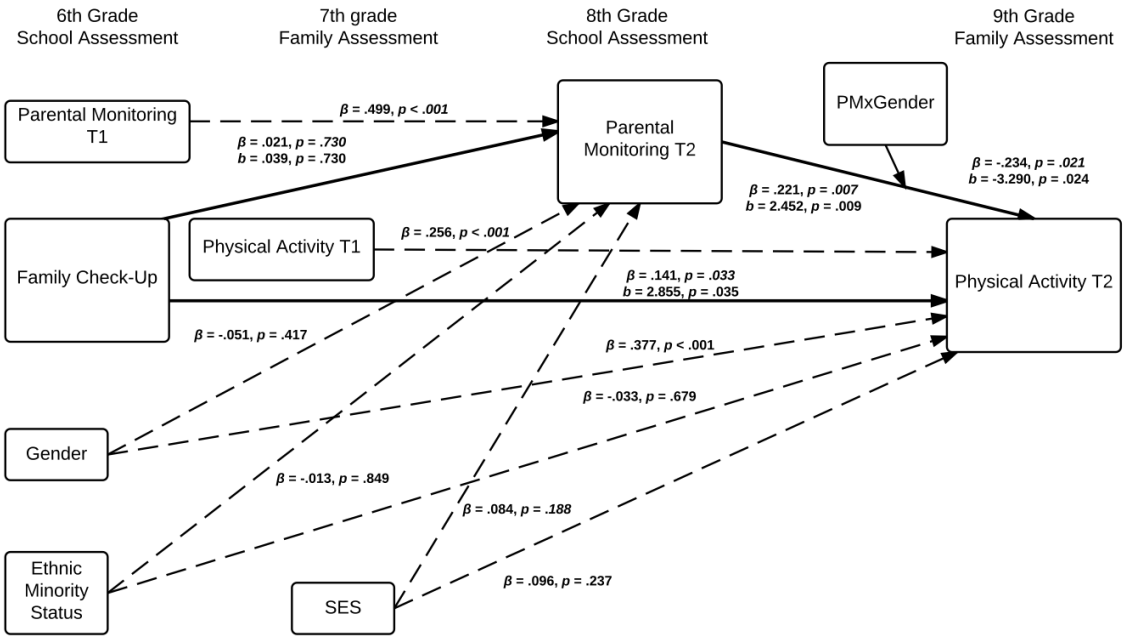


Figure 6. Moderated mediation model, parental monitoring and gender. Shows the path coefficients for the paths of interest.

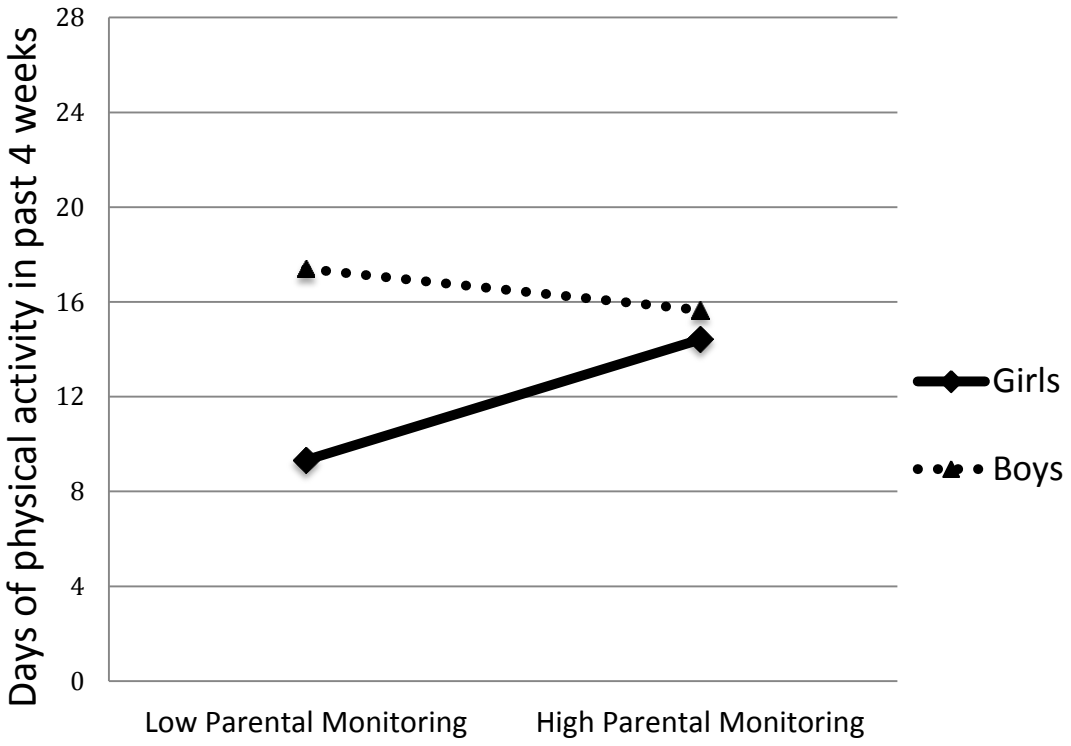


Figure 7. Interaction of gender and parental monitoring predicting physical activity. Low Parental Monitoring = one standard deviation below the mean. High Parental Monitoring = one standard deviation above the mean.

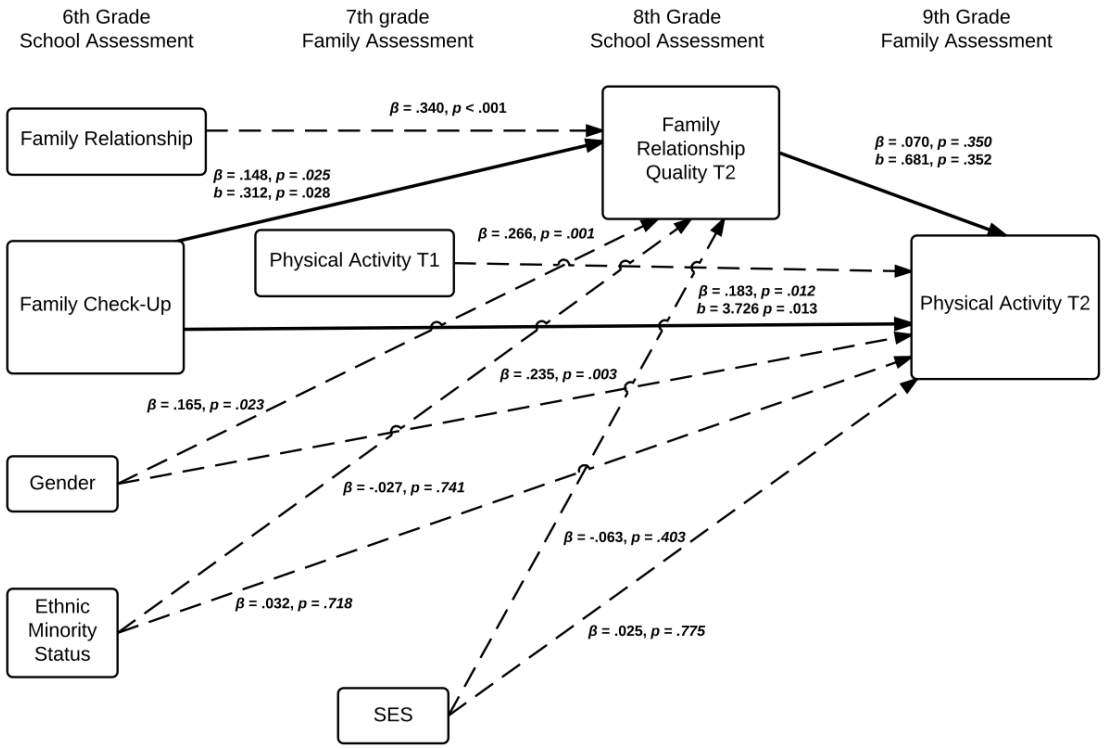


Figure 8. Mediation model, family relationship quality, received FCU vs. controls (*n* = 190). Shows the path coefficients for the paths of interest.

APPENDIX A

MEASURES

Youth Report of Physical Activity

(From the Child Health and Illness Profile – Adolescent Edition)

In the past 4 weeks, on how many days did you exercise or play sports hard enough to make you breathe hard, make your heart beat fast, or make you sweat for 20 minutes or more?

Number of days: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

Youth Report of Family Relationship Quality

(Subscale of the Community Action for Successful Youth (CASY) Questionnaire)

Think back over the last month. How true are the following statements for you and your parents? (Never true, Sometimes true, True about half the time, Often true, Always true; score 1-5 in order of increasing trueness)

1. I really enjoy being with my parents.
2. My parents and I have gotten along very well with each other.
3. My parents trusted my judgment.
4. There was a feeling of togetherness in our family.
5. Family members really backed each other up.
6. The things we did together were fun and interesting.

Youth Report of Parental Monitoring

Subscale of the CASY

	Never or almost never	Sometimes	About half the time	Often	Always or almost always
17a. How often does at least one of your parents know what you are doing when you are away from home?	☐	☐	☐	☐	☐
b. How often does at least one of your parents know where you are after school?	☐	☐	☐	☐	☐
c. How often does at least one of your parents have a pretty good idea about your plans for the coming day?	☐	☐	☐	☐	☐
d. How often does at least one of your parents have a pretty good idea about your interests, activities, and whereabouts?	☐	☐	☐	☐	☐
	1	2	3	4	5

18. In the LAST 2 days, how often did at least one of your parents know where you were and what you were doing?

Never or almost never	Sometimes	About half the time	Often	Always or almost always
☐	☐	☐	☐	☐
1	2	3	4	5

Teacher Report of Youth Risk Status

Teacher Risk Perception

TEACHER: _____

SCHOOL: _____

DATE: _____

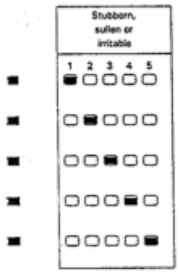
TEACHER RISK PERCEPTION

INSTRUCTIONS:

Take the sheet containing your class roster and the bubble sheet and place them side-by-side, so that the "KEY" numbers on both pages line up.

For each student, follow across the line. Read the description at the head of the column and consider to what extent it is true of the student during the last month.

Darken the bubble that best describes how true the statement is. See the example below for how to mark.

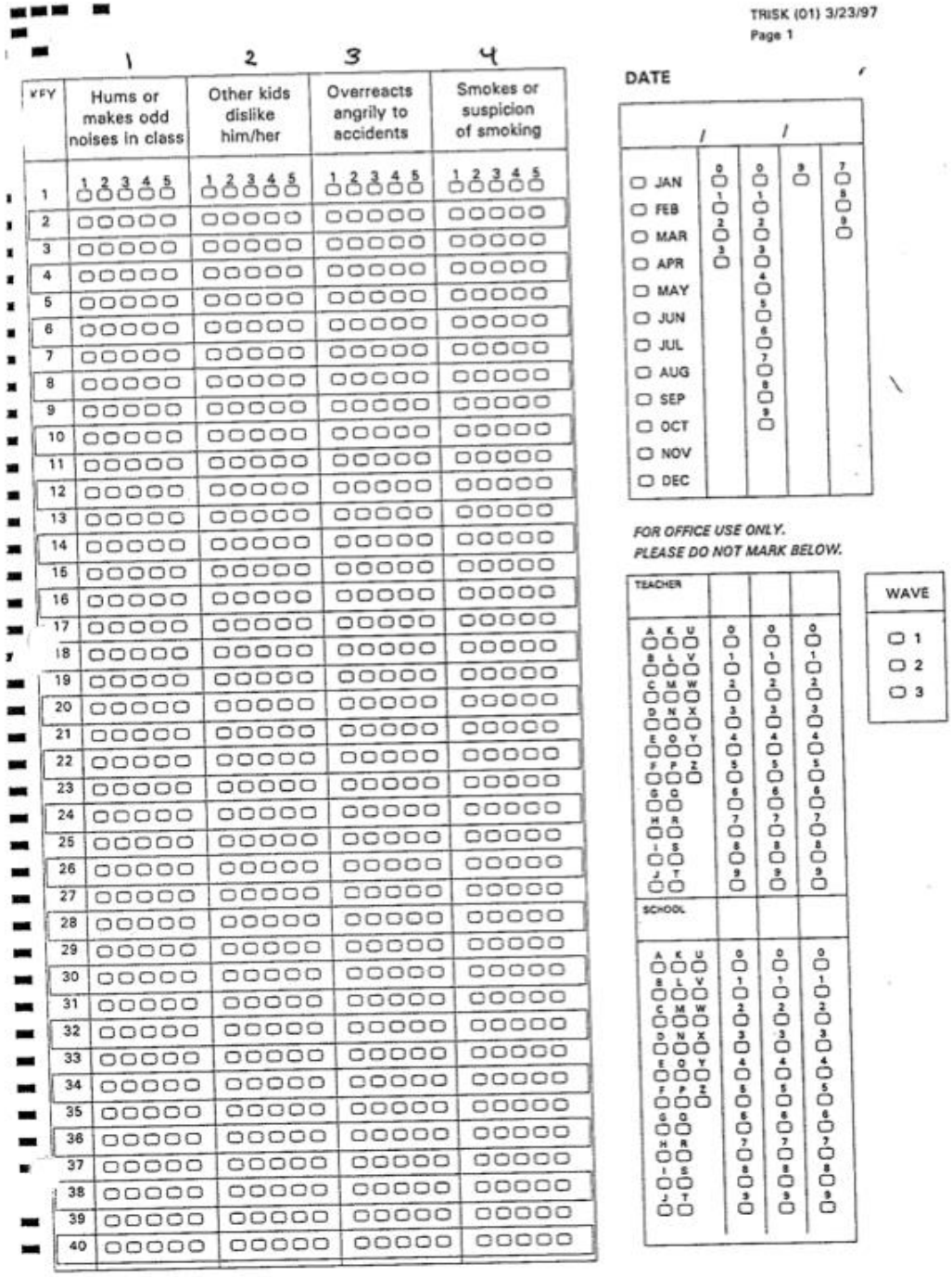


1 Never, Almost never
2 Occassionally
3 Sometimes
4 Frequently
5 Always, Almost always

The example above shows the five possible ways of describing how often this student is "stubborn, sullen, or irritable".

TRISK (01) 3/23/97
Class List

KEY	STUDENTS
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	



TRISK (01) 3/23/97
Page 1

KEY	1 Hums or makes odd noises in class	2 Other kids dislike him/her	3 Overreacts angrily to accidents	4 Smokes or suspicion of smoking
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

DATE

/ /

JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

FOR OFFICE USE ONLY.
PLEASE DO NOT MARK BELOW.

TEACHER

SCHOOL

WAVE
1
2
3

KEY	5 Argues alot	6 Prefers being with older children	7 Stubborn, sullen or irritable	8 Uses physical force to dominate	9 When teased, strikes back	10 Hangs around with troublemakers	11 Gets others to gang up on a peer
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
1	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
2	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
3	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
4	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
5	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
6	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
7	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
8	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
9	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
10	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
11	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
12	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
13	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
14	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
15	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
16	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
17	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
18	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
19	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
20	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
21	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
22	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
23	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
24	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
25	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
26	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
27	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
28	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
29	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
30	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
31	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
32	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
33	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
34	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
35	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
36	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
37	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
38	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
39	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○
40	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○	○○○○○

	12	13	14	15	16
KEY	Spends time with smokers	Blames others in fights	Threatens and bullies others	Dislikes school	Doesn't feel guilty after misbehaving
1	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					